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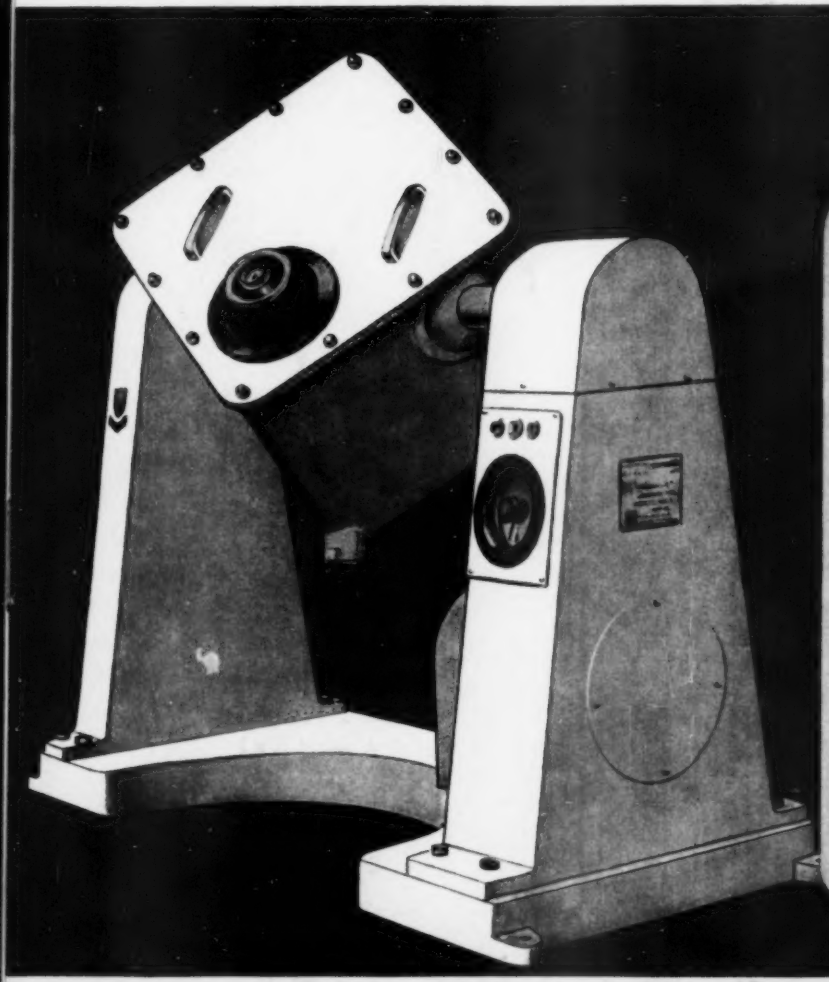
Vol. XXXII No. 2 FEBRUARY 1961



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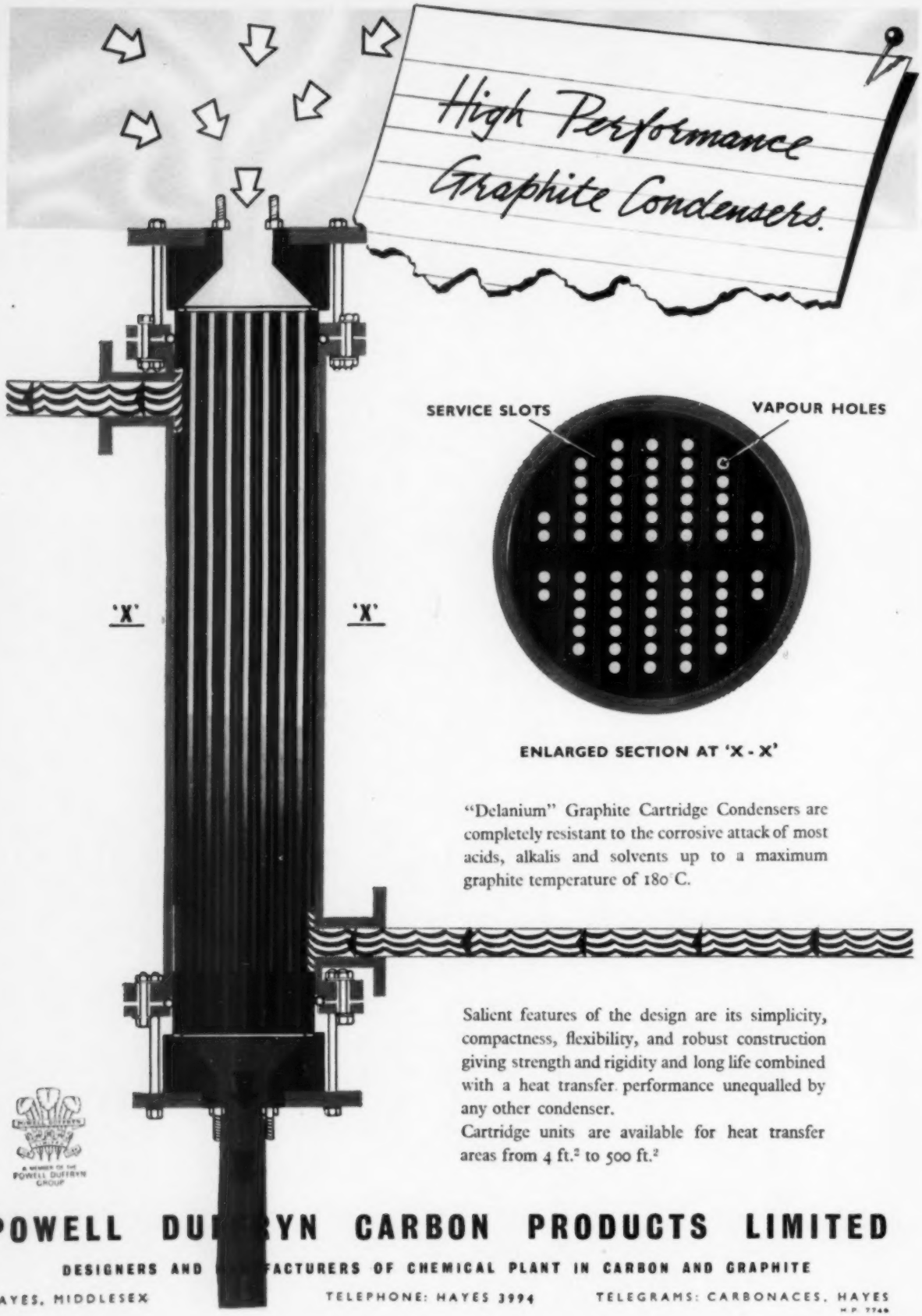

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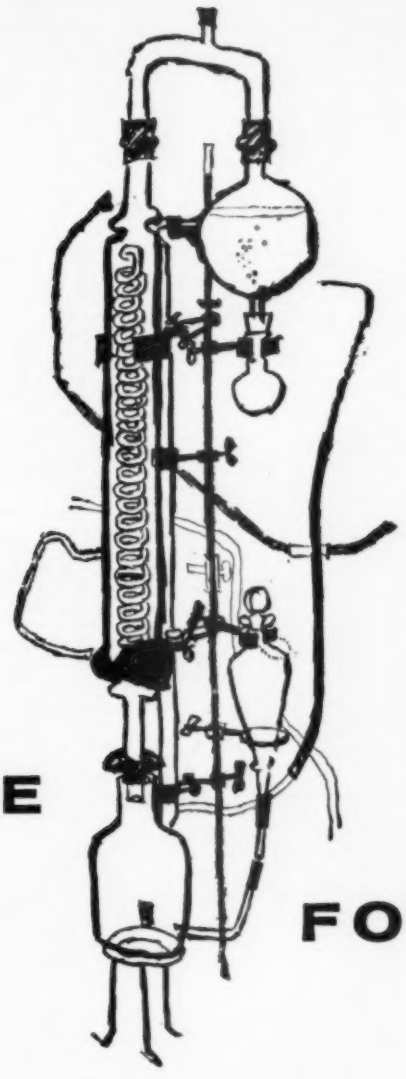

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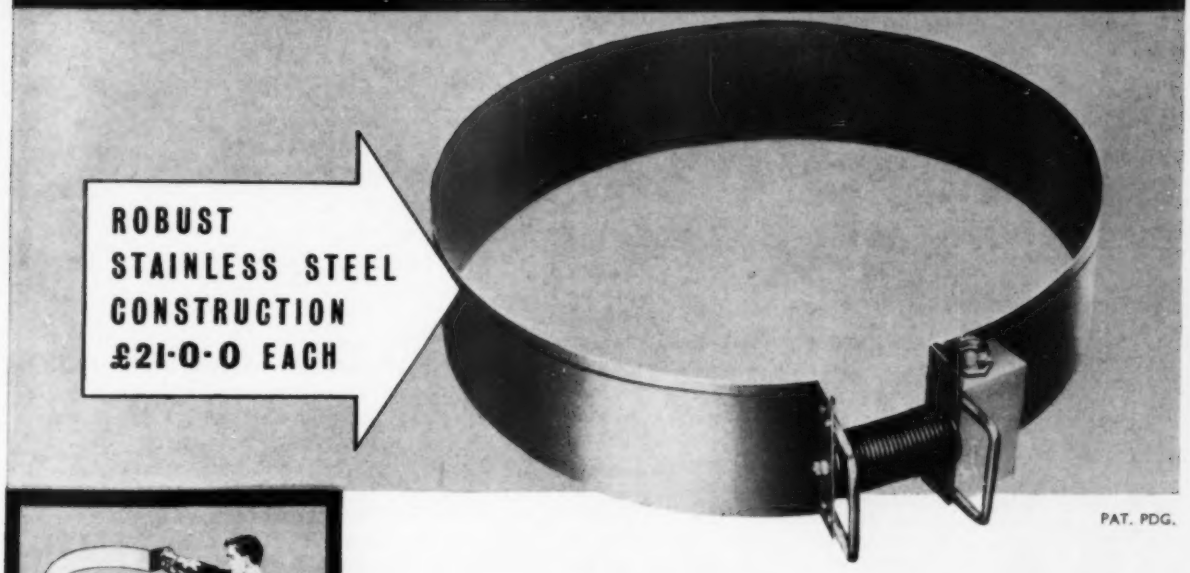

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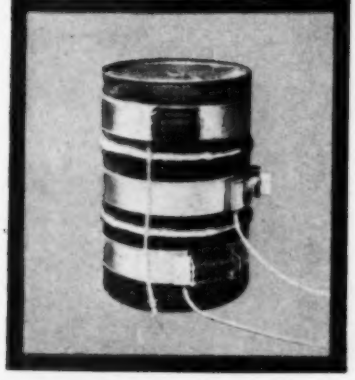

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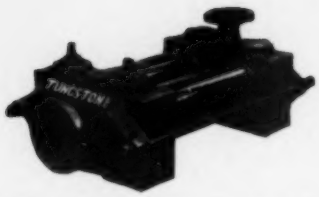

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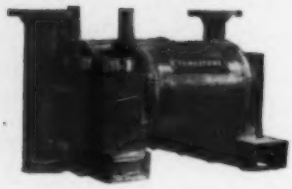

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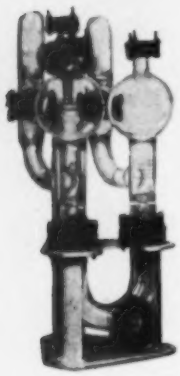

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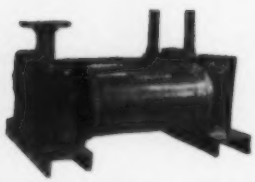

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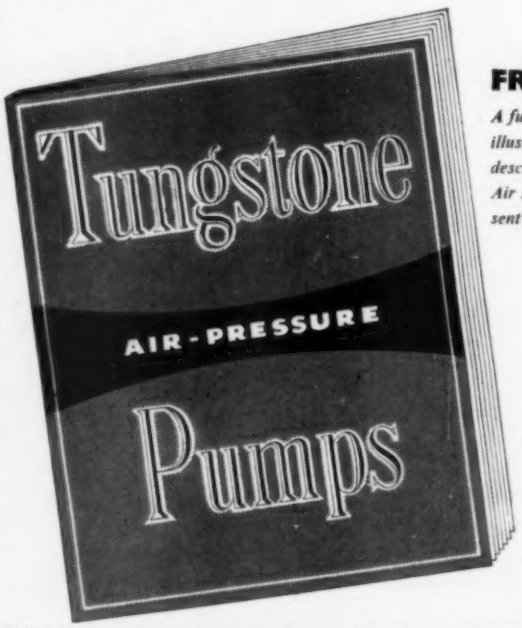

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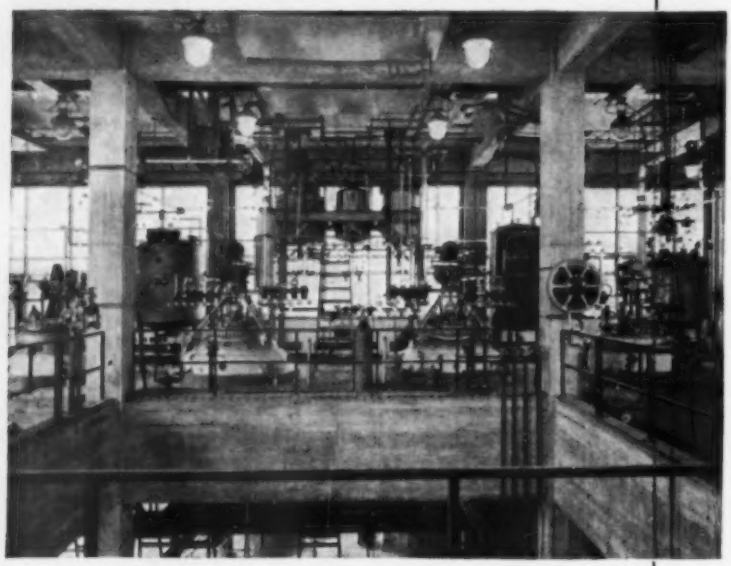

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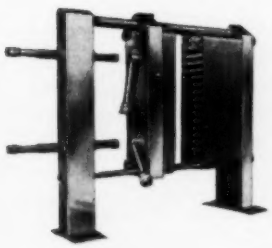
PETROLAGAR EMULSION	PHOSPHORIC ACID SOLUTIONS	PHOTOGRAPHIC DEVELOPER SOLUTIONS	POLY-VINYL ACETATE EMULSION	
POTASSIUM CARBONATE LYE	SODIUM ALUMINATE SOLUTION	SODIUM HYPOCHLORITE SOLUTION	STARCH SUSPENSION	STEARIC ACID
STODDARTS SOLUTION		SULPHUR DIOXIDE SOLUTION (DILUTE)	SULPHITE COOKING ACID	SULPHITE WASTE LIQUOR
	SUCROSE SOLUTION		WAX EMULSIONS (THICK)	
				WHITE SPIRIT
				WORTS (VARIOUS)
				YEAST CREAM

APV Heat Exchangers



APV Paraflow Plate Heat Exchangers With fully accessible, easily cleaned contact surfaces of stainless steel, titanium and certain other corrosion resistant metals, the Paraflow is without equal for handling liquids that are corrosive or require hygienic conditions. Capacities may be extended at any time by the inclusion of more plates and a number of duties can be performed simultaneously in one frame. Available in a wide range of sizes and frame types.

APV Rosenblad Spiral Heat Exchanger Embodying a compact spiral design and made in mild steel, stainless steel, Monel and certain other materials to meet a wide variety of operating conditions. One or more of the three basic types will handle saturated gases, vapours, liquids or sludge. Removable end covers permit easy access to heat exchange passages.

APV

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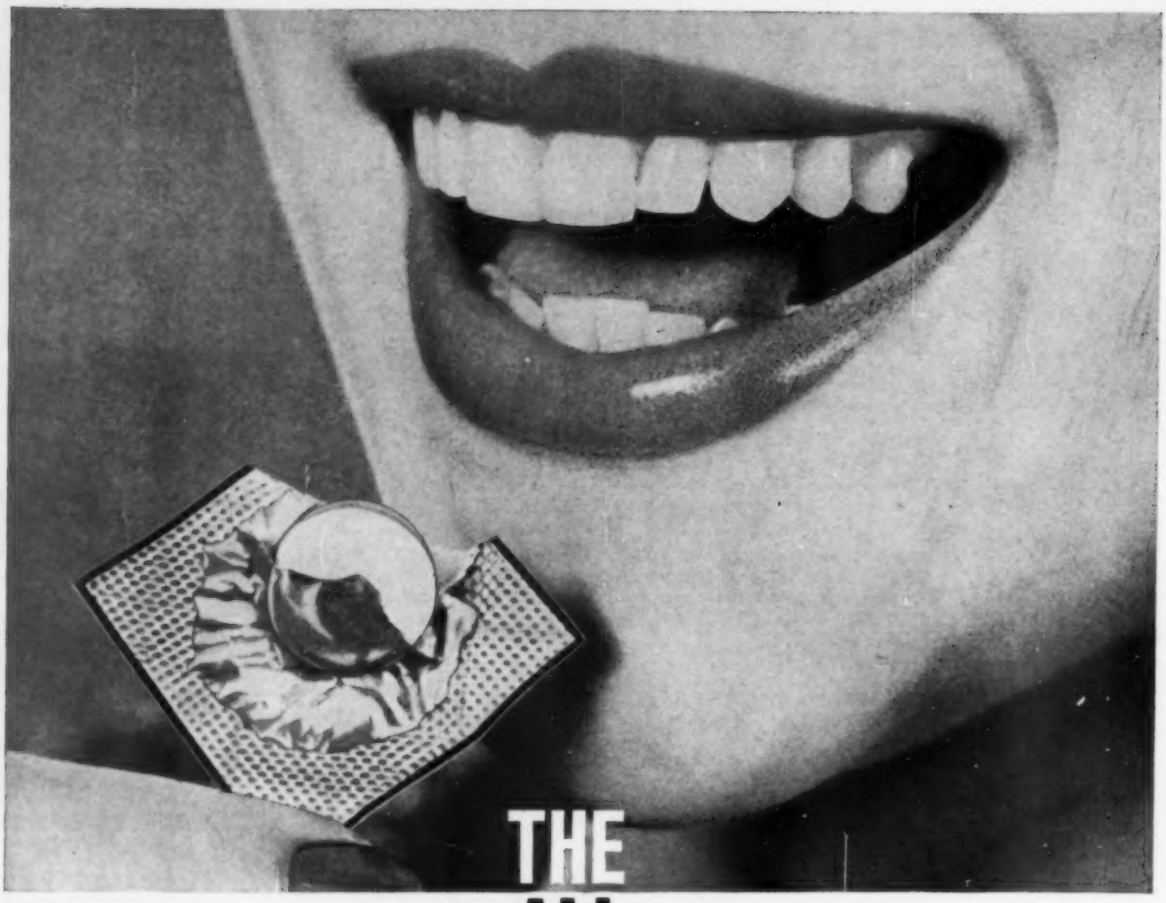
TELEPHONE: CRAWLEY 1360. TELEX: 8737. TELEGRAMS: ANACLASTIC, CRAWLEY



THE ALL IMPORTANT MOMENT

THIS is the moment all your research, your manufacture and packaging have led up to: the moment of taking. How good is your product then?

In Venesta Foils' strip, it will be just as it left your factory. *Individual* packaging has sealed it from air, light and dirt; protected it in transit; kept it untouched by hand—even the user's.

Yet in the long run Venesta Foils' strip packaging costs *less* than other and less hygienic ways of packing. Our advisory service will be glad to show you why.

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The five freedoms of Venesta Foils' strip

Freedom from contamination—your product individually sealed
Freedom from damage—in delivery, storage and carrying
Freedom from high labour costs—packing is fully mechanised
Freedom from bulk—easier handling, lower freight costs
Freedom for design—each individual item carries your name, trade mark or dosage right up to the moment of taking.

strip packaging by

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Mixing capacity: 4 litres. Revolutions per minute (free running): low 14,000, medium 17,000, high 19,000. Motor: 230-240v 50 c/s, single phase. Switch settings: Off, Low, Medium, High. Container: stainless steel with stainless steel blades and handle—two piece clamp-on splash cover with sealing gasket and stainless steel cover for sampling and adding ingredients. Overall height: 23 in. Weight: 36 lb. net.

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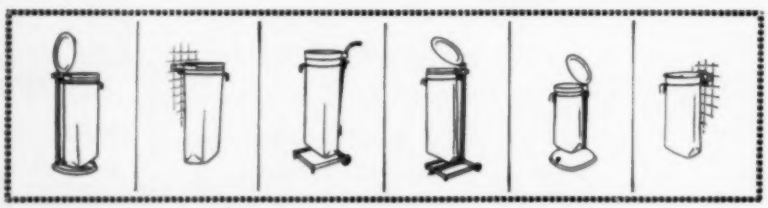

Sack-holders manufactured and supplied by Cartem Engineering Ltd., London, under Patent Number 809109

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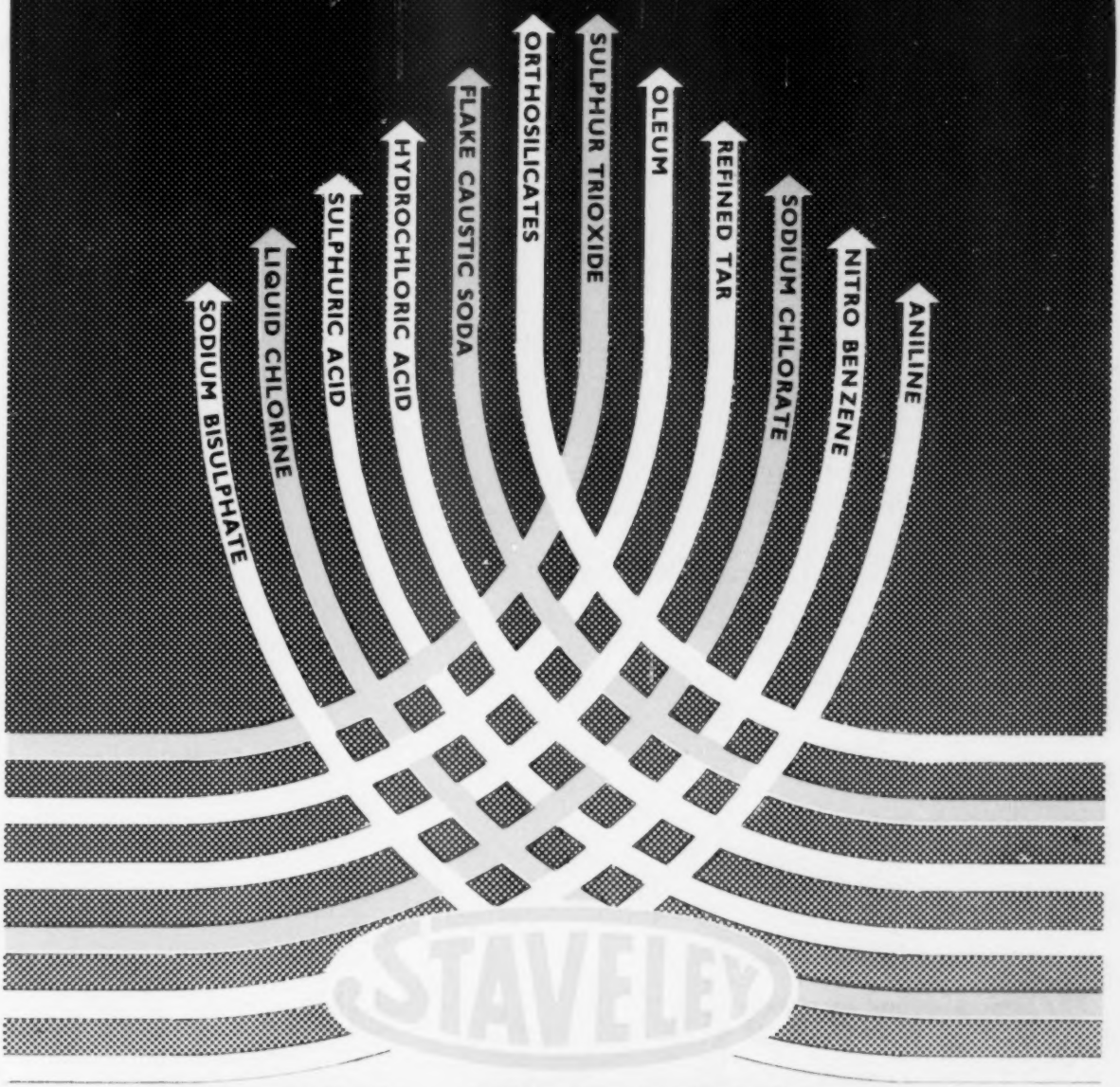

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Tall and semi-squat

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In response to persistent demands from all sectors of the pharmaceutical industry, Metal Box are offering a stock range of plain aluminium extruded containers. These can now be ordered in lots from 25 to 300 depending on the size of tube. The tubes are unprinted, with screw caps, fitted with a polythene-faced cork wad. They are attractive, extremely lightweight, and they afford considerable protection to their contents. *Send today for leaflet giving full details.*

SIZES—*20 different sizes are available from 15 mm-75 mm in diameter and 40 mm-230 mm in depth, to give a fluid capacity range of ½ fl. oz. to 24 fl. oz.*

* **Metal Box continues to supply both printed aluminium and plastic tubes, custom made to suit requirements of individual manufacturers.**

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MB 23/01

metal and plastic
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METAL BOX

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Aluminium tubes. *Diameters from 12·5mm to 75mm with depths from 1·5 to 7 times the diameter, maximum 230mm.*

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Chemical 'Inertia'

This drawing is one of a series by the late Gerard Hoffnung originally commissioned by British Visqueen Limited for the 1955 Packaging Exhibition.

Another outstanding property of 'Visqueen' polythene film

Aunt Mabel knows a thing or two about potions and nostrums – she's been living off them for years. Despite them she remains remarkably healthy. Immunity from chemical attack is not however the prerogative of medicine bottles or invalid aunts, for on 'Visqueen' polythene film most corrosive substances make no impression at all.

'Visqueen' is completely non-toxic and chemically inert, so whatever your product, it can be safely packed in 'Visqueen' without risk of contamination. Since 'Visqueen' is also tough and waterproof it makes a reliable liner for drums, sacks and cartons, sealing off the contents completely, and is in constant demand for the packaging of chemicals, food-stuffs and hygroscopic powders.

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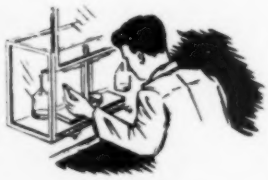

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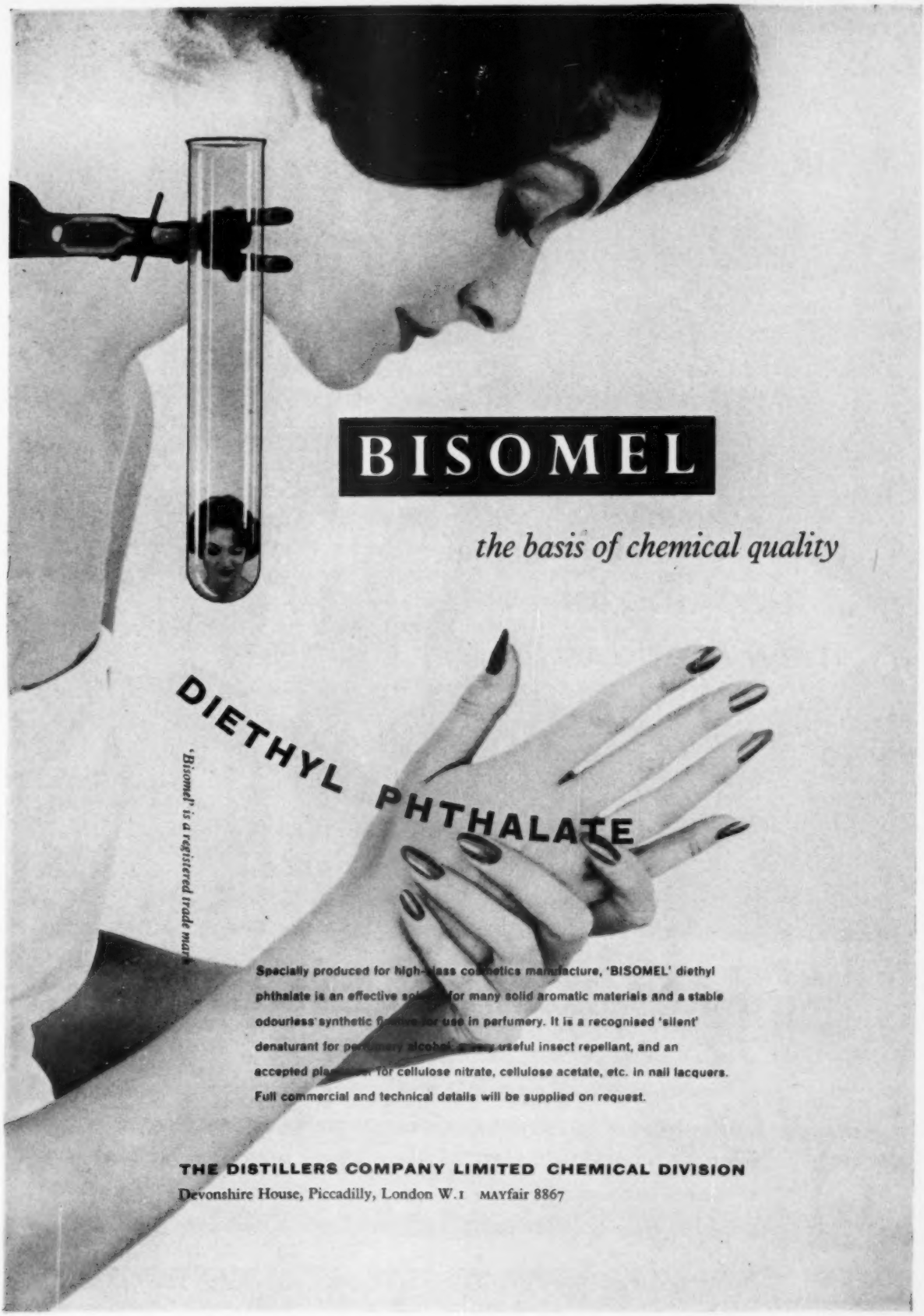
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the basis of chemical quality
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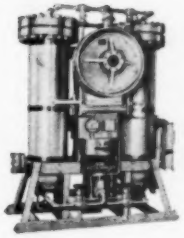

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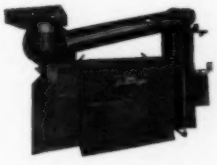
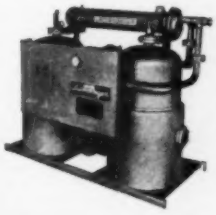


An air conditioning dryer of the type used in such plants as sweet factories.



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did Confucius say

"To go too
is as bad
not
go
far enough"*

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* *This of course is what Confucius actually said.*

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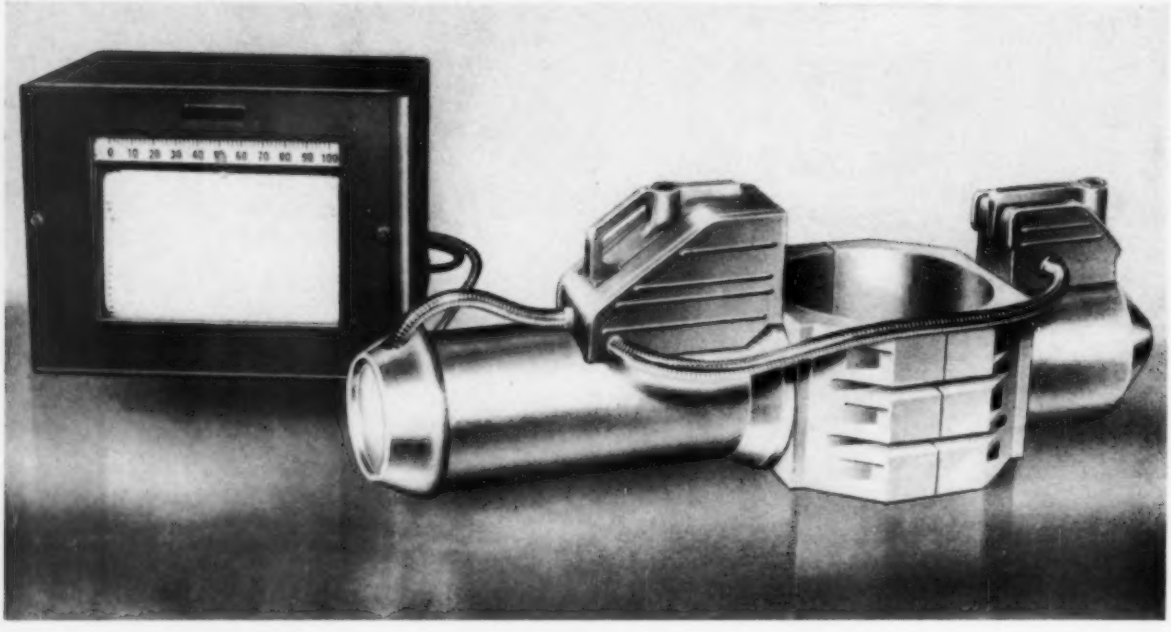

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Glovers (Chemicals) Ltd., Wortley Low Mills, Leeds, 12 Telephone: 63-7847/8/9 Telegrams: "Glokem, Leeds".

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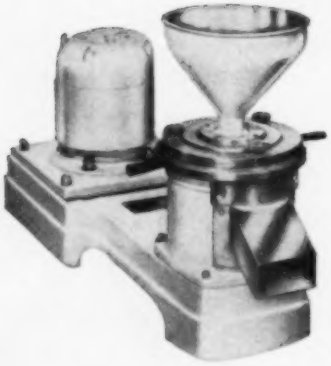

Are your competitors using a Premier 3" Multipurpose Mill? If so, it has solved their dispersion, emulsification and fine grinding problems. No wonder they're keeping quiet about it! Small manufacturers or large organisations–all who are concerned with the economical handling of small batches–find it gives results identical to those obtained on larger equipment.

Taking up only three square feet of bench space, this unit disperses, fine grinds and emulsifies at the rate of 5 to 50 gallons an hour. There is absolutely no wastage whether the amount processed is a pound or a ton. The Mill involves little capital outlay and maintenance is negligible since it cleans as easily as a saucepan.

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The illustration shows batteries of these electric heating units developed for standard fibre tests carried out by the British Flour Millers Association Research Laboratories.

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At meetings such as this, John and Sylvia Reid, world-famous industrial designers, together with the heads of the Jackson Packaging Advisory Service, are evolving a range of glass containers that are 'purpose-built' and second to none; containers designed with specific products in mind—perhaps those you are manufacturing right now!

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In the coming months, these 'purpose-built' containers will be available for you to see. But why wait until we have completed the series—call, write or 'phone us now, and see for yourself the progress we have already made.

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2 *John Reid, A.R.I.B.A., F.S.I.A.*
3 *Duncan Sutcliffe, Commercial Director, Jackson Glass*
4 *Sylvia Reid, A.R.I.B.A., F.S.I.A.*
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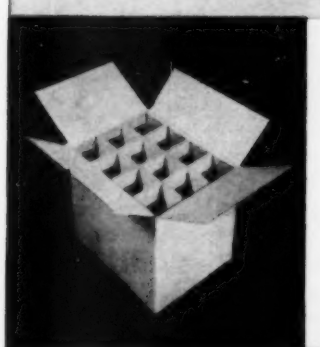

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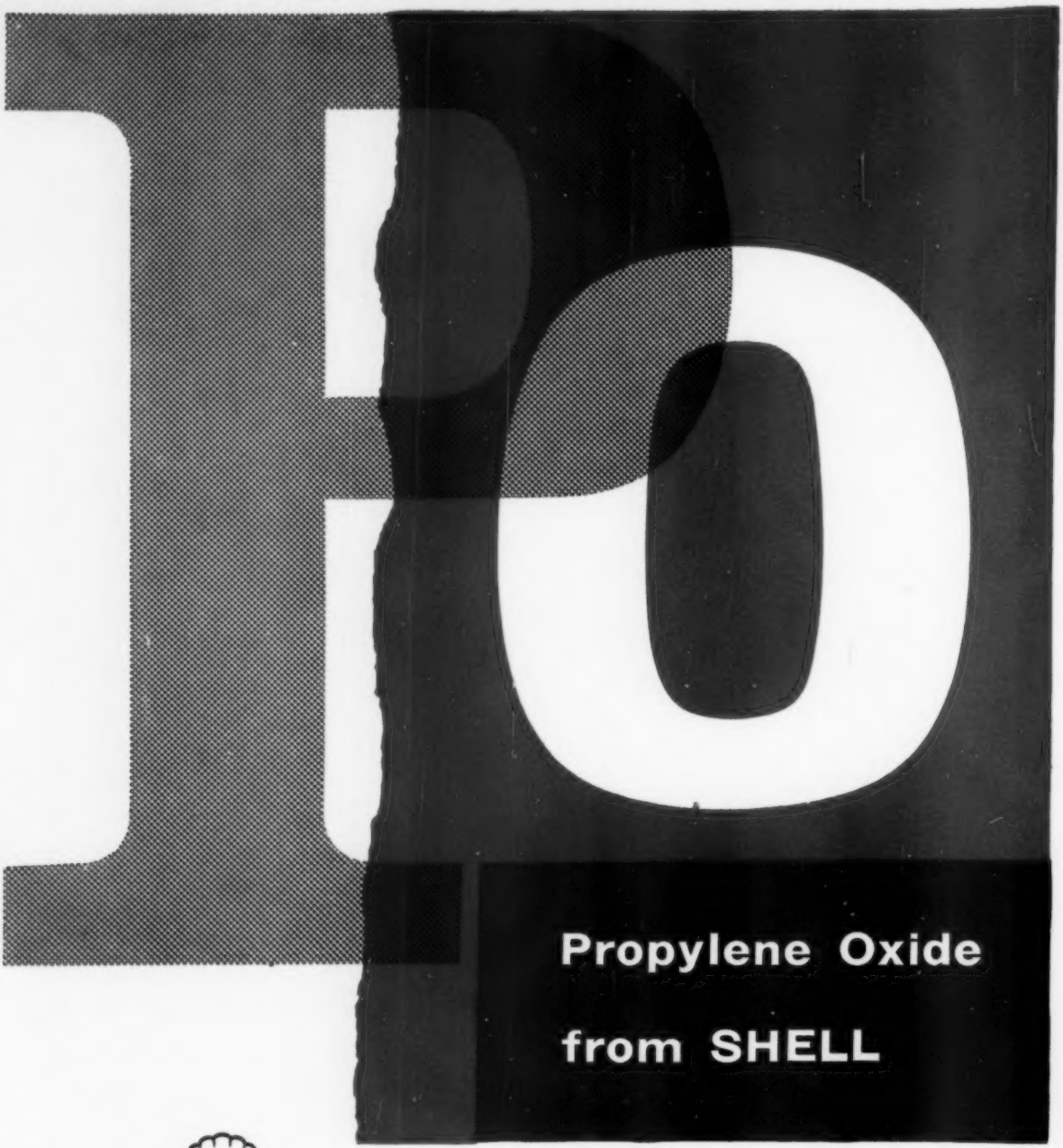

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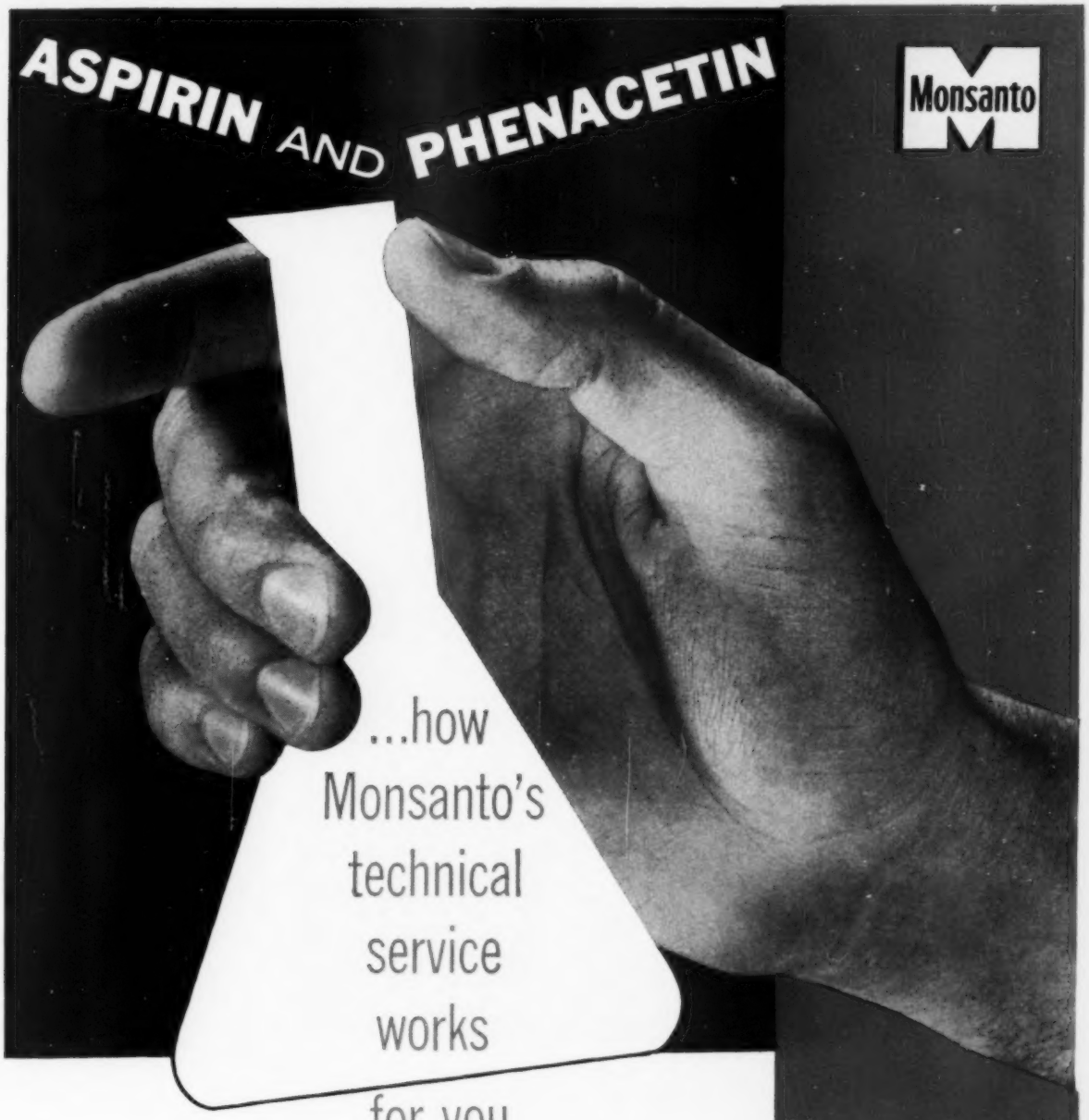

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- ✓ Cartons - greaseproof lined
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- ✓ Cartons - two piece
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- ✓ Can Trak

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- ✓ Outers - display
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- ✓ Trays - corner stitched

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9-Anthracene aldehyde
Arachyl alcohol 99%
Sehenic Acid
Behenyl alcohol 90%
Behenyl alcohol 98%
Benzidine acetate
Benzyl ethyl carbinol
Benzyl iodide
Benzyl isothiocyanate
Benzyl mercaptan
Bornyl benzoate
2-Bromoheptane
3-Bromoheptane
4-Bromoheptane
p-Bromophenacyl bromide
1-Bromo-3-propanol
Butadiene sulphone
Butene-2-diol-1,4
Calcium galactonate
Calcium glucoheptonate
Calcium glycerate
Capricnitrile 99%
Caprylnitrile 99%
Carbazole (very pure)
Cephalin (ex Hog's Brain) pure
Cerium salicylate
ortho-Chlorobenzyl chloride
6-Chloro-hexanol-1
3-Chloro-propanol-1
2-Chloro-pyridine
Colchicine USP XIV
Copper guaiacol sulphonate
Cupric dibenzene sulphonate hexahydrate
Cyclodecanone semicarbazone
Cyclododecane
Cyclododecanol
Cycloheptane
Cycloheptanol
Cycloheptanone
Cycloheptylamine
Cyclohexane-1,4-biscarbinol
Cyclohexyl urea
Cyclooctanol
Cyclooctanone
Cyclooctanone isoxime
Cyclooctylamine
Cyclopentyl urea
Cyclopentylamine
Decahydrocinnamic aldehyde
Decahydro-beta-naphthyl acetate
beta-Decalol (cis trans mixed)
Decamethylene-1,10-dicarboxylic acid
Decamethylenedinitrile
n-Decane 99% (Olefin free)
Decanediol-1,10
1-Decene 95%
n-Decylamine 99%
Diaminodecane-1,10
Diaminododecane-1,12
Diaminoheptane-1,7
Diaminononane-1,9
Diaminooctane-1,8
Diaminoundecane-1,11
1,4-Dibromobutene-2
Dibromodecane-1,10
Dibromohexane-1,6
Dibromononane-1,9
Dibromooctane-1,8
Dibromopentane-1,5
Dichlorodecane-1,10
Dichlorohexane-1,6
2,3-Dichloro-1,4-naphthoquinone
Dichloropentane-1,5
Dicyclopentadienyliron
Dicyclopentylamine
Di-n-decylamine
Di-n-dodecylamine
Didymium salicylate
Diethanolamine salt of maleic hydrazide
asym-Diethyl ethylenediamine
Diethyl suberate
N-Diethyl amino acetonitrile
*1,5-Dihydroxy naphthalene
*2,7-Dihydroxy naphthalene
2,3-Dimercaptopropanol
2,2-Dimethyl-diaminopentane-1,5
a,a-Dimethylglutaric acid
Dimethyl-methylsuccinate
2,7-Dimethyl-2,7-oct nediol
2,4-Dimethyl-3-pentanol (Di-isopropylcarbinol)
3,3-Dimethylpiperidine
2,5-Dimethylpyrrole
2,4-Dimethyl resorcinol
2,5-Dimethyltetrahydrofuran (water free)
Dimethyl thapsate
Di-n-octylamine 99%
n-Docosane 95%
1-Docosene 95%
Dodecahydro-beta-naphthyl acetate
n-Dodecane 99% (Olefin free)
1-Dodecene 95%
n-Dodecylamine 99%
2,2-Diphenylethylamine-1
n-Eicosane 95%
1-Eicosene 95%
1, 2-Ethanedithiol
4-Ethoxy-3 methoxy benzaldehyde
2 Ethyl-1-butene 95%
Ethyl-4-chloro-2-methylphenoxy acetate
6-Ethyldecanol-3
(Ethyl-(3-ethyl)-heptylcarbinol)
5-Ethylheptanol-2
(Methyl-(3-ethyl)-pentylcarbinol)
2-Ethyl-1-hexene 95%
5-Ethylnonanol-2
(Methyl-(3-ethyl)-heptylcarbinol)
6-Ethyloctanol-3
(Ethyl-(3-ethyl)-pentylcarbinol)
Eugenyl methyl ether
Ferric tartrate pure
Furfuryl acetate
Furoic acid 98% & 99 8%
Glyceryl-para-aminobenzoate
Heptamethylenedinitrile
2,2,4,4,6,8,8-Heptamethylnonane 95%
n-Heptane 99% (Olefin free)
n-Heptanol-2 (Methyl pentylcarbinol)
Heptanol-3
Heptanol-4 (Di-n-propylcarbinol)
1-Heptene 95%
n-Heptadeclamine pure
n-Heptylamine 99%
n-Hexadecane 99% (Olefin free)
1-Hexadecene 95%
n-Hexadecylamine 99%
Hexahydrobenzaldehyde
Hexahydrobenzyl alcohol
(Cyclohexane methanol)
Hexahydro-p-xylyldiamine
Hexamethylenedinitrile
Hexamethylene-imine
3-Hexamethylene-imino-propionitrile
3-Hexamethylene-imino-propylamine
n-Hexane 99% (Olefin free)
Hexanediol-1,6
Hexanediol-2,5
Hexanol-2 (Methyl-n-butylcarbinol)
Hexanol-3 (Ethyl-propylcarbinol)
1-Hexene 75%
Hexylcinnamic aldehyde
1-Hexyne
2-Hexyne
3-Hexyne
Lanthanum salicylate
Lauronitrile (n-Undecylcyanide
beta-Mercaptoethylamine HCl
Mercury acetamide
Mercuric succinimide
5-Methoxy-1-chloropentene-2
5-Methoxy-3-chloropentene-1
6-Methylcoumarin
3-Methylcyclopentanediol-1,2
3-Methylcyclopentanedione-1,2
Methyl cyclopentylamine
3-Methyl-5-ethyl-heptanediol-2,4
3-Methyl-5-ethyl-nonanediol-2,4
2-Methyl-7-ethylnonanol-4
(Isobutyl-(3-ethyl)-pentylcarbinol)
3-Methylheptane 95%
3-Methylheptanediol-2,4
3-Methylheptanol-2
(Methyl-(1-methyl)-pentylcarbinol)
3-Methylheptanol-5
2-Methylpentanediol-1,3
3-Methylpentanediol-2,4
3-Methylpentanol-2
(Methyl-(1-methyl)-propylcarbinol)
2-Methyl-1-pentene 95%
4-Methyl-2-pentene 95% (mostly trans)
Methylsuccinic acid
*3-Methyl thiophene
Methyltuberate
Myristonitrile 99% (n-Tridecylcyanide)
Nitrocyclohexane
5-Nitro-2-furfuraldehyde diacetate
5-Nitrofurfurylidene diacetate
o-Nitrophenylacetic acid m.p. 138°C
Nonamethylenedinitrile
Nonanediol-1,9
5-Nonanol (Di-butylcarbinol)
n-Nonylamine 99%
n-Nonylcyanide 99%
n-Octadecane 99% (olefin free
1-Octadecene 95%
n-Octadecylamine 99%
iso Octanoic acid
Octamethylenedinitrile
Octamethylene-imine
n-Octane 99% (Olefin free)
1-Octene 95%
2-Octene 95%
1,8-Octolactam
iso Octylamine
tri iso Octylamine
di iso Octylamine
n-Octylamine 99%
Palmitronitrile 99% (n-Pentadecylcyanide
Pentadecane (traces Tetradecane)
n-Pentadecylamine 99%
n-Pentadecylamine pure
Pentamethylenedinitrile
Pentanol-3 (Diethylcarbinol)
2-Pentyne
Phenanthrene-9-aldehyde
2-Phenylamino-pyridine
(2-Anilino-pyridine)
1-Phenylbutanol-2
beta-Phenylethyl iodide
beta-Phenylethyl isocyanate
beta-Phenylethyl isothiocyanate
Phenyl isopropyl aldehyde
3-Phenylpropylamine-1
bis gamma Phenylpropylethylamine Base
bis gamma Phenylpropylethylamine dihydrogen citrate
3-Piperidino-propionitrile
3-Piperidino-propylamine-1
Potassium creosote sulphonate
Potassium mercaptophenyl-thio-thiodiazolone
1, 3-Propanedithiol
3-Pyrrolidino-propionitrile
3-Pyrrolidino-propylamine-1
Resorcinol diethyl ether
Salicyloyl hydrazide
Salicylhydroxamic acid
Sebacyl dichloride $COCl(CH_2)_8COC$
Serotonin creatinine sulphate
Sodium dichloroacetic acid
Sodium phytate
Sphingomyelin (ex cerebro)
Stearonitrile 99% (n-Heptadecylcyanide
trans-Stilbene
Suberic acid
Terephthalaldehyde
Terpineol iodide
Terpineol saponate
Terpineol isothiocyanate
n-Tetradecane 99% (Olefin free
1-Tetradecene 95%
n-Tetradecylamine 99%
Tetrahydrofurfuryl salicylate
Tetrahydropyran
Theophylline-7-acetic acid
Thioacetamide
Thiosalicylic acid m.p. 160°C +
Triamyl citrate
Trichlorodimethylphenylcarbinol acetate redist
Trichlorohexahydro-beta-naphthol
n-Tridecylamine 99%
Trimellitic anhydride
2,6,8-Trimethyl-4-nonanol
Tri-n-octylamine 90/95% & 99%
dl-Tryptophane pharmaceutical
L-Tyrosine
2-Undecanol (Methylnonylcarbinol)
6-Undecanol (Di-amylcarbinol)
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Variamine Blue Indicator

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most
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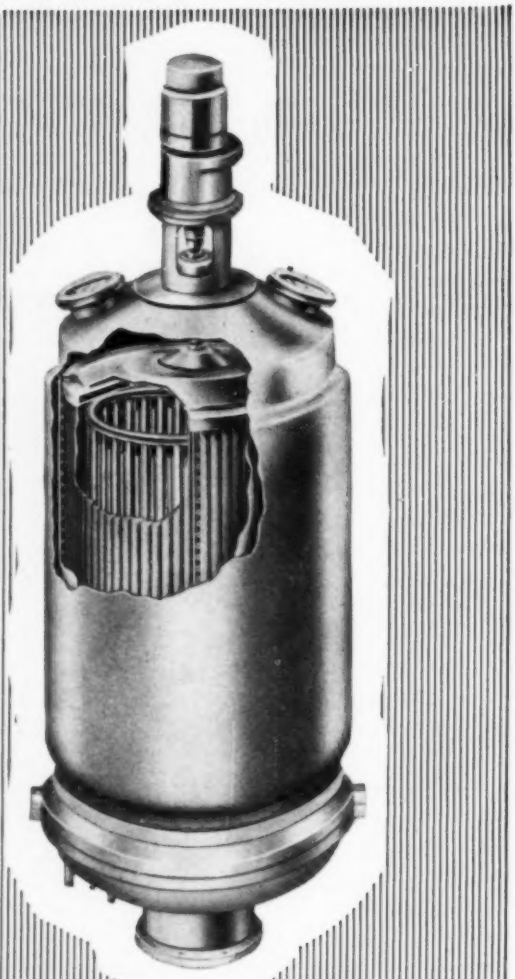

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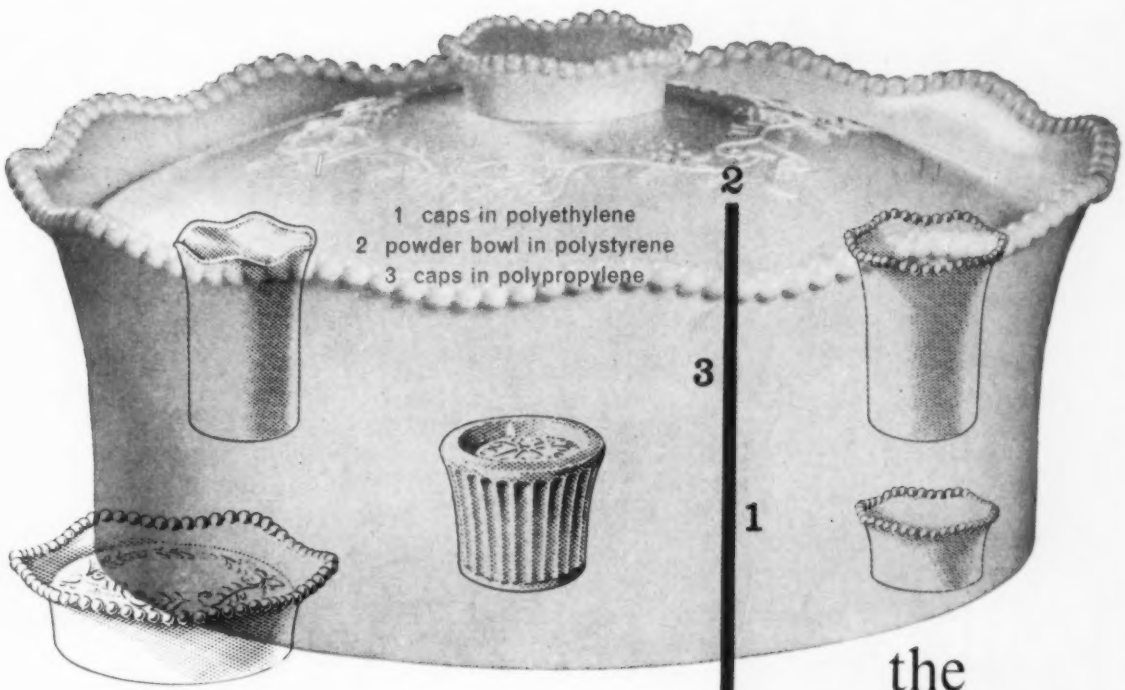

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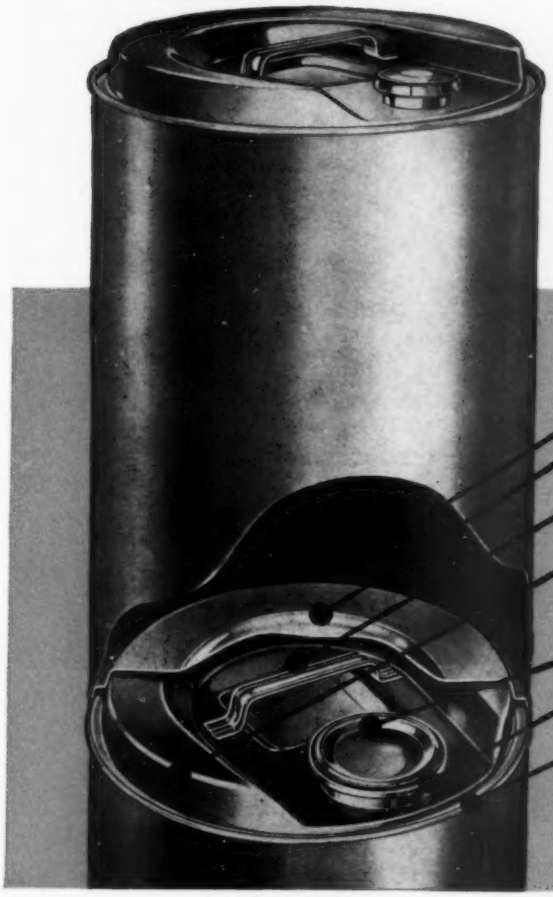

New design gives maximum security in stacking

The new Metal Box drum stacks rigidly at all times—not only when it's new and empty, but when it's in use. New design of top and bottom gives extra strength, while allowing for possible bulging caused by internal pressure from contents.

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- Internal lacquers as required.
- Specially domed bottom for extra strength: the dome can 'give' and the drum will still stack safely.
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- Wide range of closures.
- Rim of neck proud of rim of countersink, so that water cannot percolate into contents.
- Stackability is maintained even if the countersink is damaged.
- Printed designs to order. Durable, attractive colours.

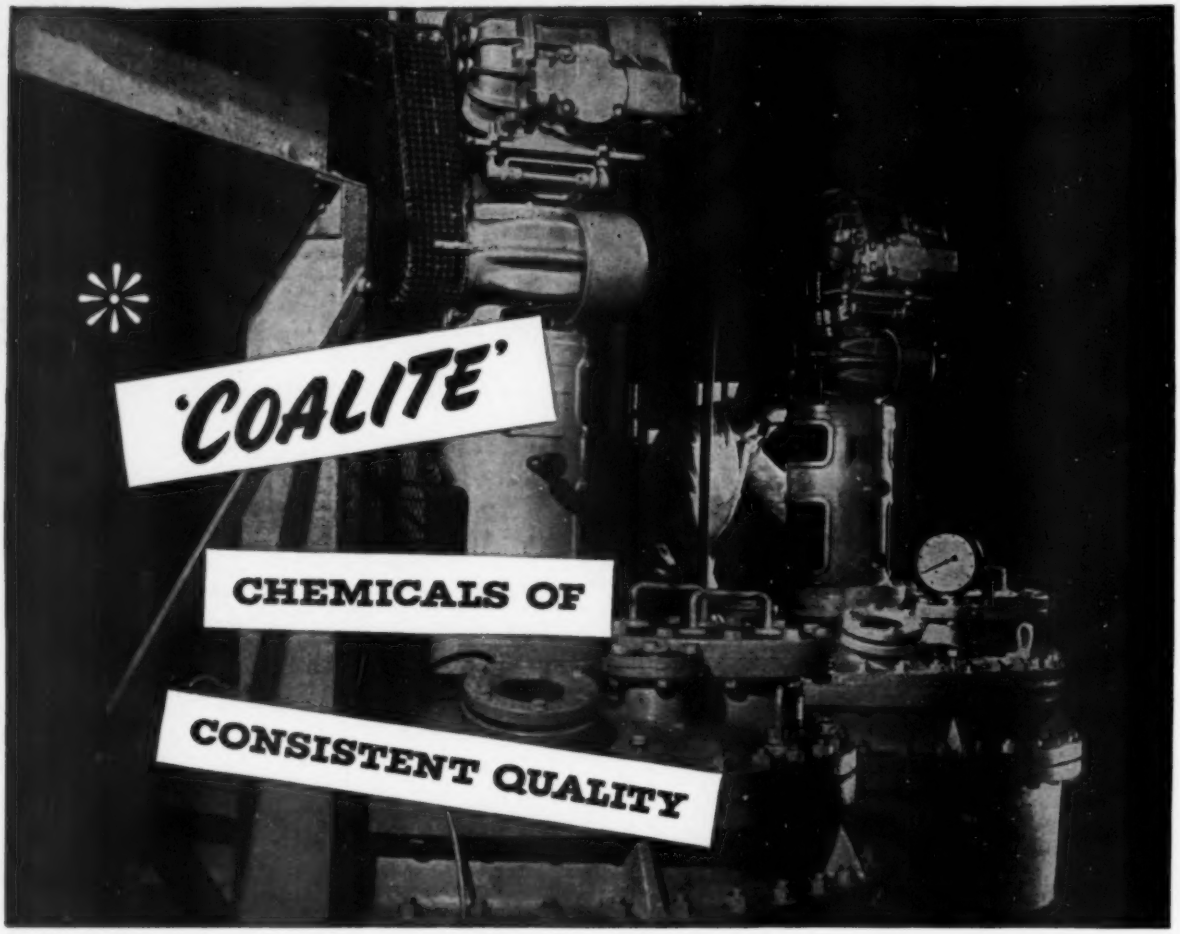
This new design is the result of extensive research. Metal Box has produced models, carried out laboratory tests, experimented with prototypes, and made up batches of samples filled with users' products. Major users were invited to put the new drum to work in their own plants, under everyday conditions, and their views on the new design were obtained. The result is a drum that is thoroughly reliable, shaped to meet users' requirements, and proved to be efficient and safe. Write today for more information.

MB METAL BOX

THE METAL BOX COMPANY LIMITED · 37 BAKER STREET · LONDON W.1 · HUNTER 5577

Processed Food Cans · Metal Containers · Paper Products · Plastic Packages and Laminations

MB 21/45/B



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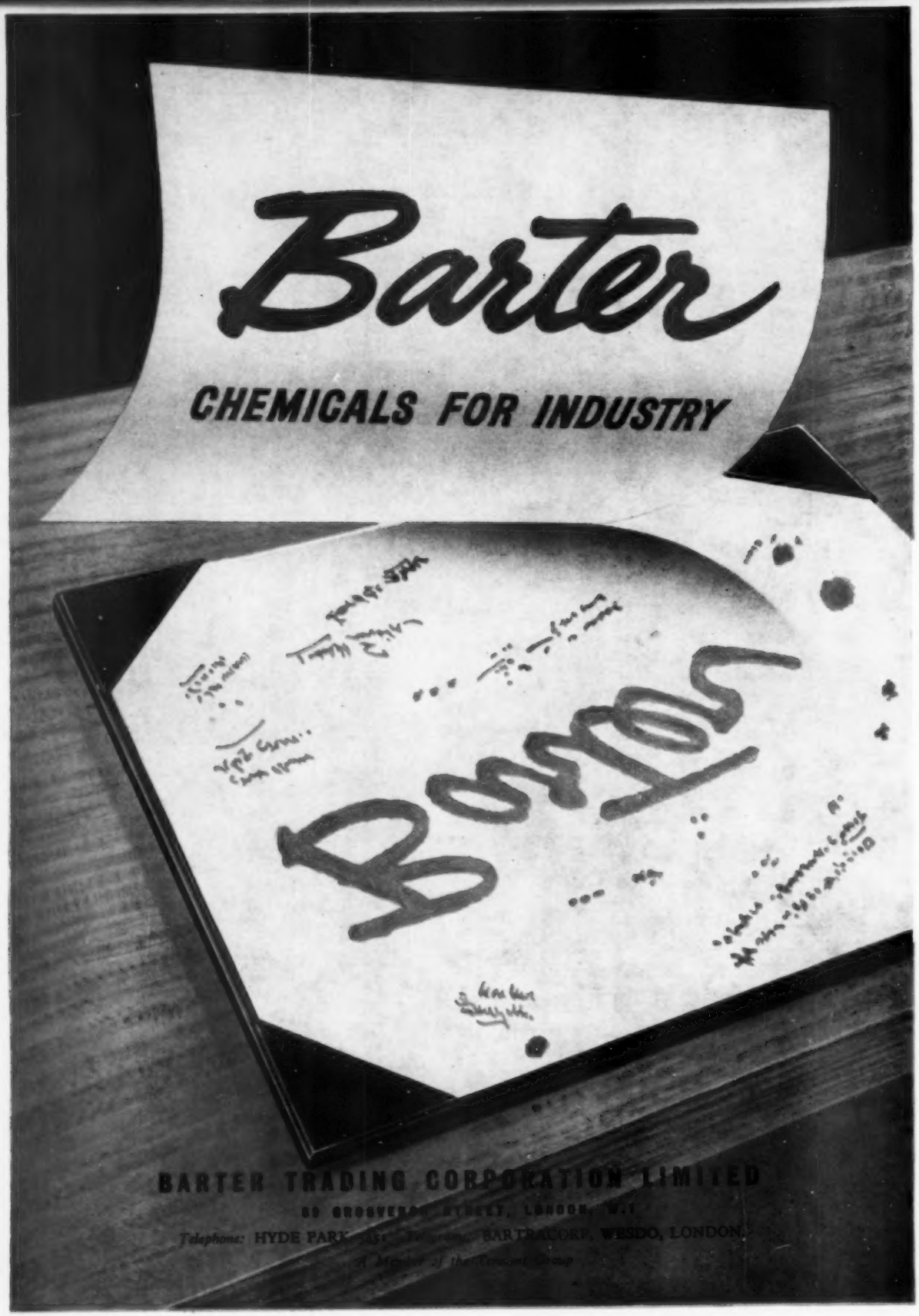
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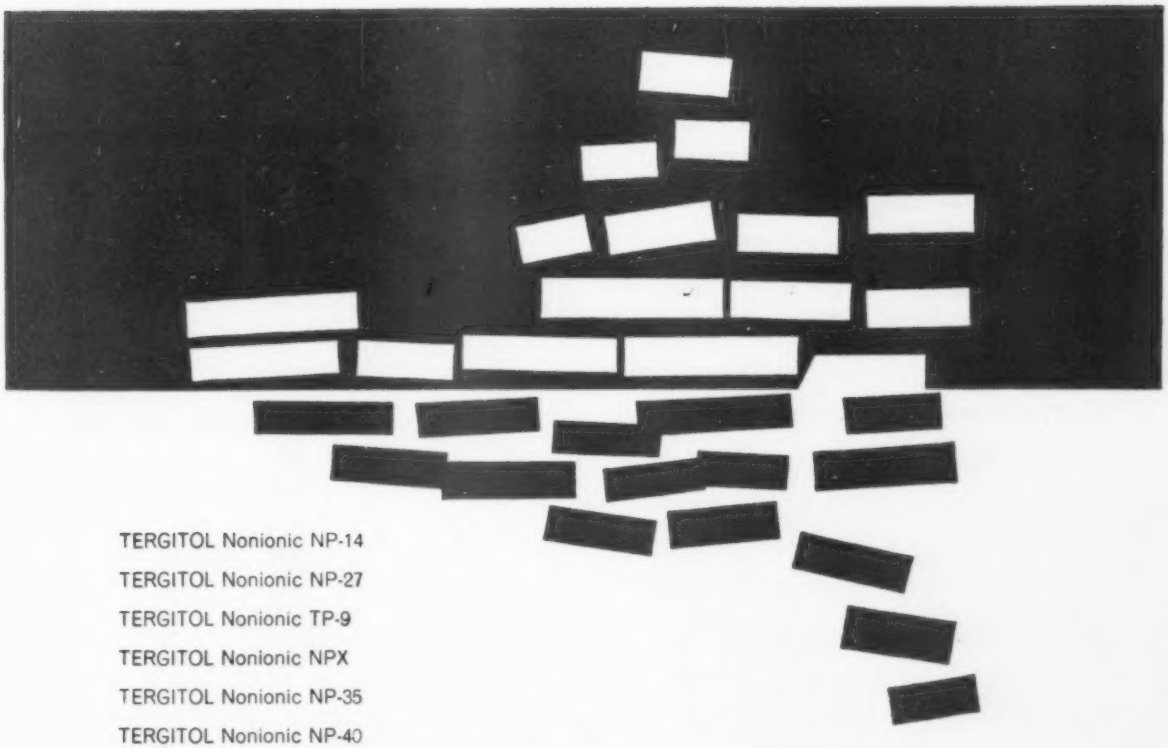

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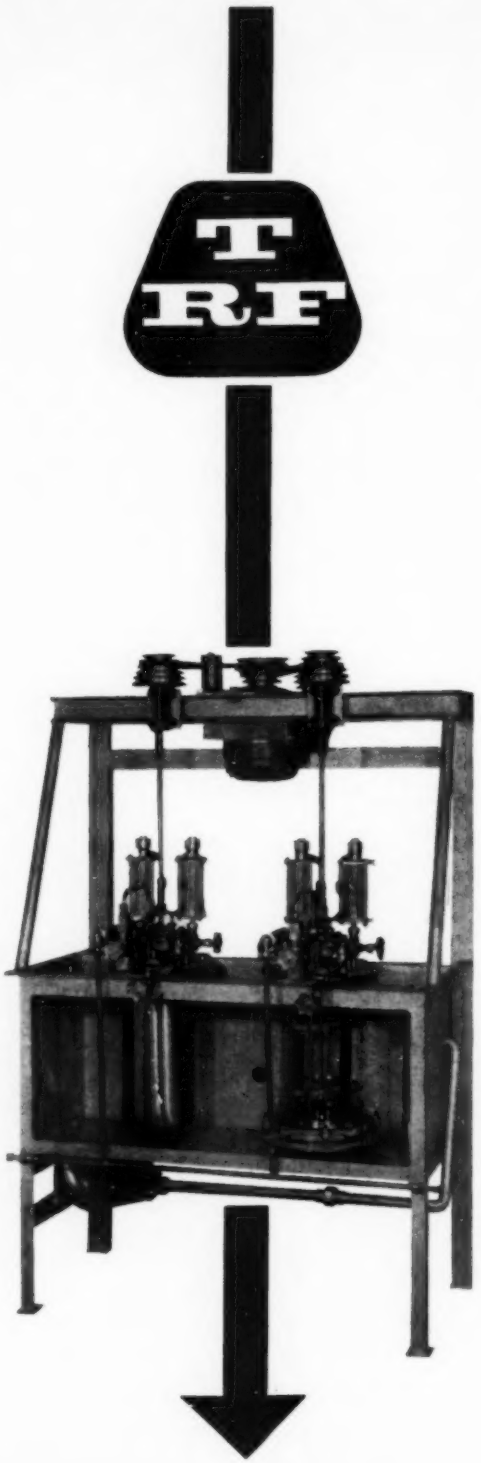

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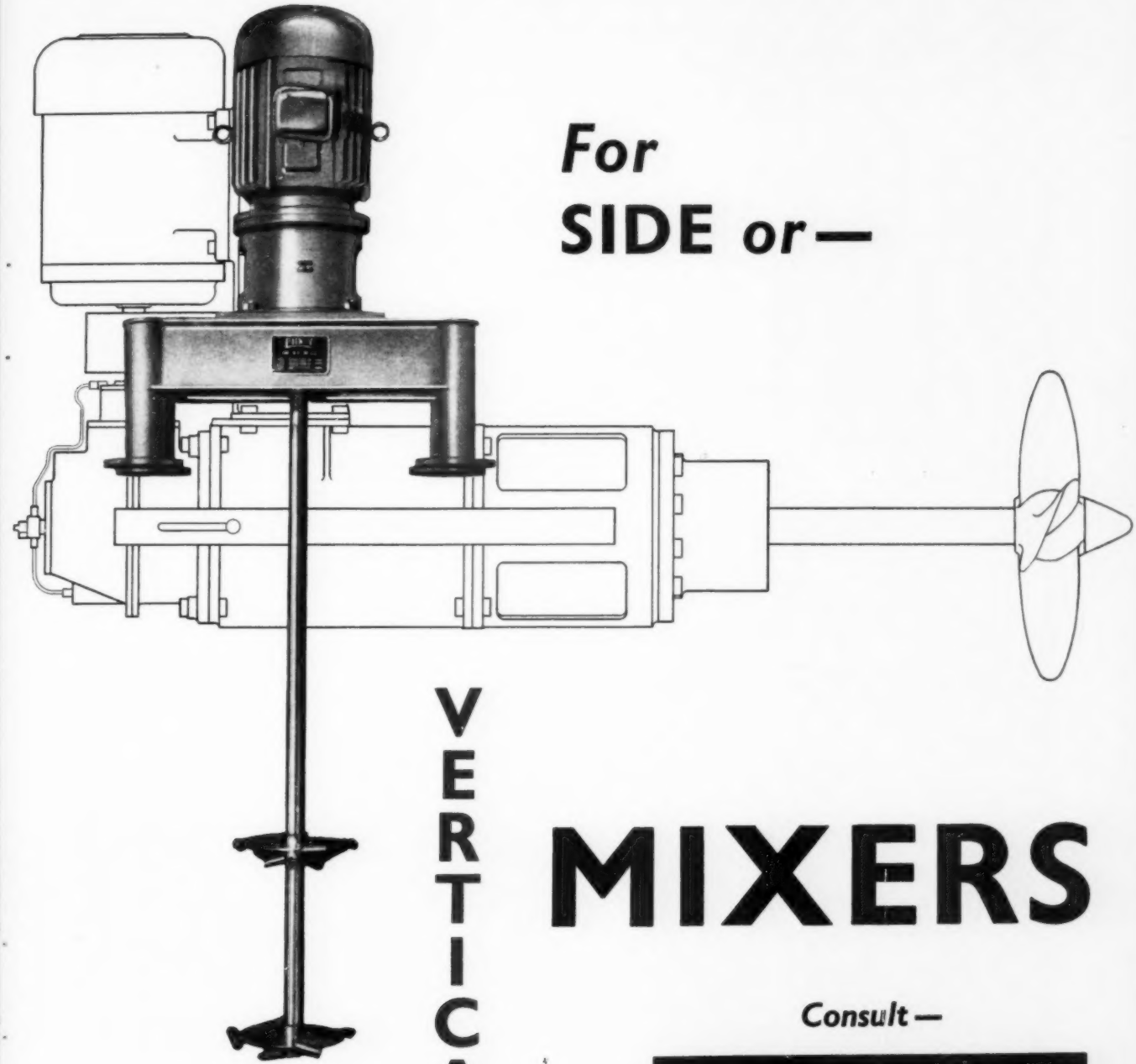

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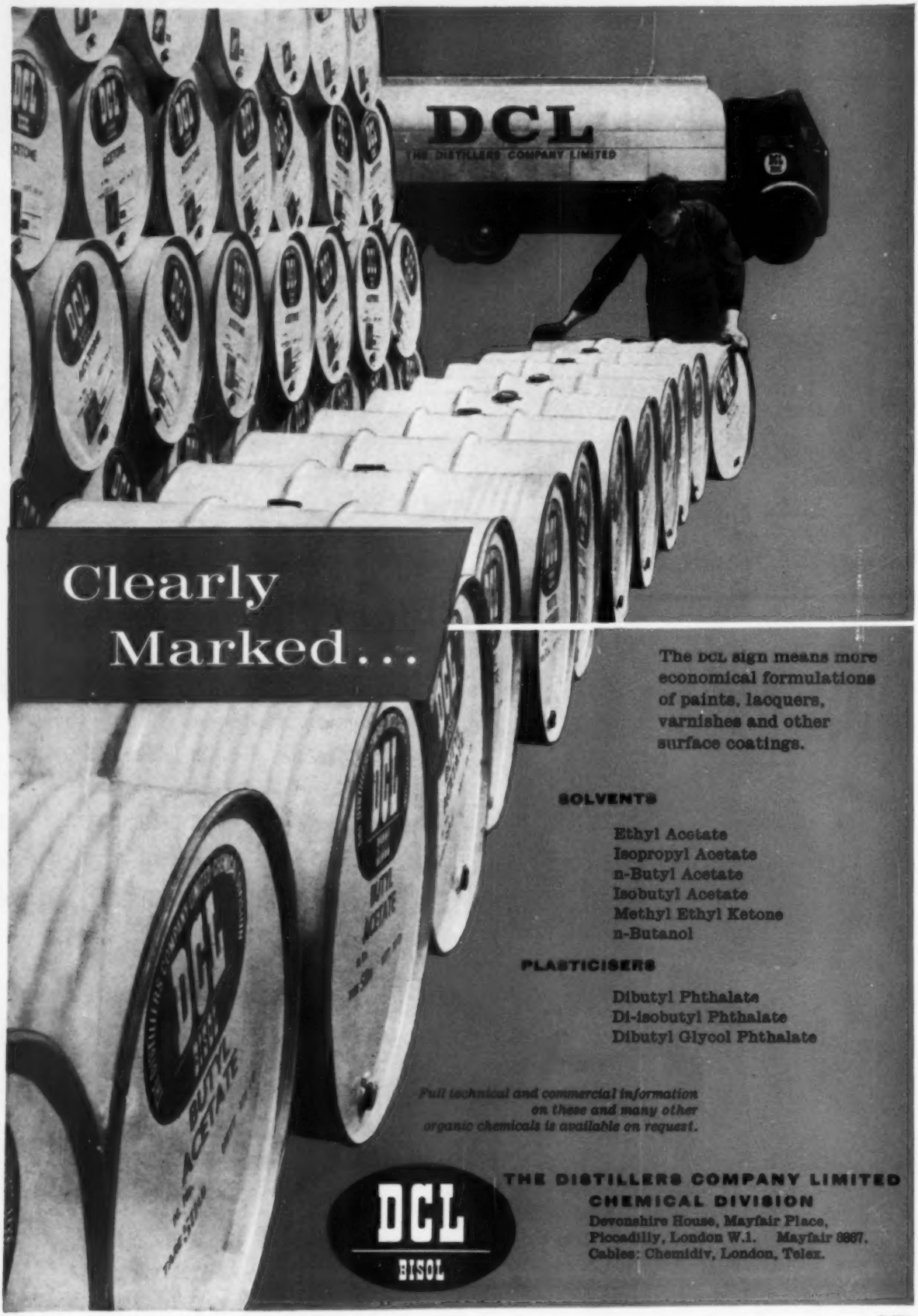

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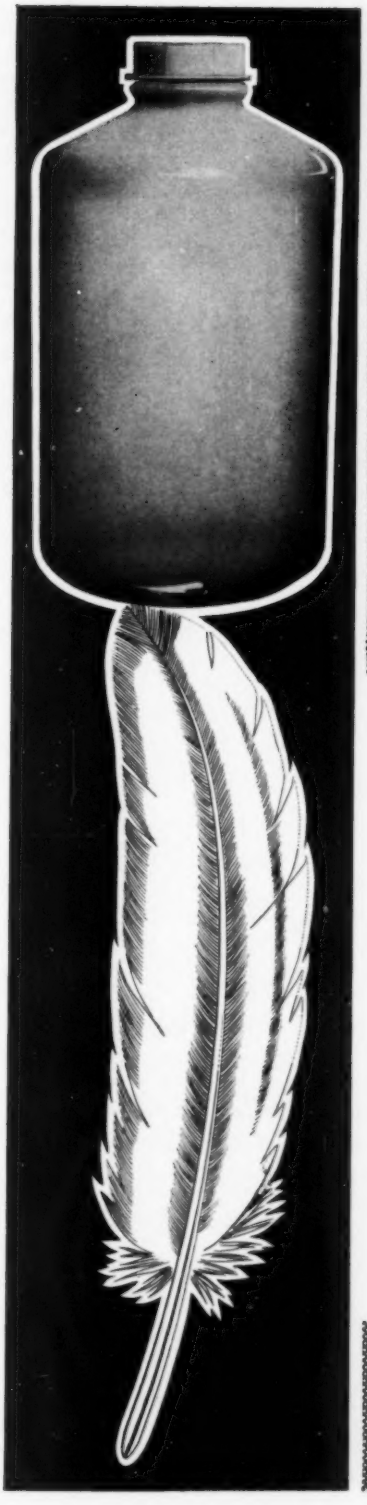

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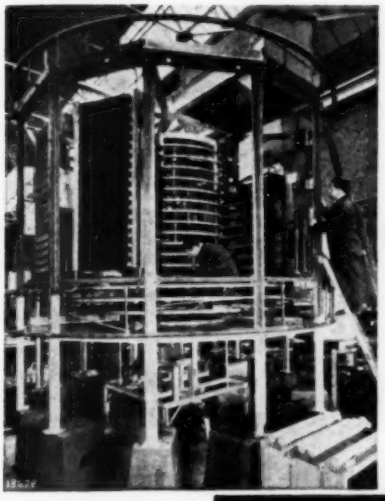

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A £500 million export market?

BRITAIN's export trade is not prospering. Last year our exports declined from a monthly average of £300 million to £257 million. The reason for this is that traditional markets are getting much tougher and there are now formidable competitors like the United States, Germany and even France. This alarming situation is causing many businessmen to look more and more longingly at the markets of the communist world. The political arguments for not trading with Russia, China and their satellites are diminishing as competition increases. Government restrictions and embargoes on East-West trade are being progressively relaxed and are likely to disappear altogether. In this situation the British Council for the Promotion of International Trade, the president of which is Lord Boyd-Orr, is beginning to see the fulfilment of its efforts to get trade moving across the ideological barriers between us and the Eastern bloc.

Recently the Council brought together at a reception the trade representatives of the communist countries in London and representatives of a number of British firms, including I.C.I., Shell, Dow Chemical, Biddle Sawyer, British Cellophane and British Resin Products. The chemical and chemical plant industries, of course, have long seen the possibilities of establishing a prosperous trade with communist countries. Russia has ordered from this country two detergent factories worth £3 million, two sugar factories worth £8 million, and a £650,000 polystyrene plant. Rumania has ordered a £250,000 vegetable oil refinery. The Russians are eager to negotiate licences to use British chemical processes and it is significant that the chairman of I.C.I. was recently in Moscow on this business.

If we can make up our minds about the desirability of full East-West trading, immense export possibilities open before us. Lord Boyd-Orr thinks that within two or three years we could raise our exports to these countries to £500 million p.a. We have tried embargoes, but these have not prevented Russia from making spectacular technological progress, to the extent that she can now teach us. Can we afford to continue ineffective restrictions and deny British industry access to huge markets?

The Glaxo-Evans link-up

THE proposed take-over of Evans Medical Ltd., by Glaxo will make the Glaxo group the biggest British-owned pharmaceutical organisation. In the last accounts the Glaxo group assets were shown as £37·29 million. At the end of 1959 Evans' net assets were placed at £3·7 million. But the two ardent bidders for the company—Fisons and Glaxo—value them a good bit higher. Fisons offered £6·8 million for the company and Glaxo came back with what seems to have proved an unanswerable offer of £8·3 million, which Evans' directors are recommending their shareholders to accept.

Fison's third failure to make a take-over (the other two were Crosse and Blackwell and B.D.H.) provided the financial journalists with columns of copy and comment. One implied they were gatecrashers, a comment that displays ignorance of Fison's pharmaceutical interests. In fact the company behaved quite straightforwardly; it made a good offer and when a remarkably better counterbid was made, withdrew.

Glaxo and Evans have many complementary interests—in vaccines and antibiotics, for instance. Since bombs destroyed their factory in the heart of Liverpool, Evans have built a fine group of factories, laboratories and warehouses on a 30-acre site at Speke, just outside Liverpool. They make organic compounds, sterile products, tablets, powdered drugs and many other products. Their latest unit—the virus vaccines laboratories—is described in this issue of MANUFACTURING CHEMIST.

One of Evans' notable achievements since the war was the building of the Burma Pharmaceutical Industry (see "M.C." January 1959). The Allenbury part of the Glaxo group is currently building a pharmaceutical industry in Persia. Apart from its manufacturing operations, Evans run an extensive wholesale drug trade and over the years has bought up small wholesalers in different parts of the country. It has also been active overseas. Under its chairman, Mr. Ian Fergusson, it has come a long way and it should find a sympathetic parent in Glaxo.

Fifteen years' remarkable growth

THOUGH Glaxo is considered a young company in comparison with Evans (founded 1809) in fact its origins go back almost 90 years. In 1873, Joseph Nathan, a settler in New Zealand, acquired a business that eventually developed into the Glaxo group. Joseph Nathan was a merchant and in 1876 he opened a London office to handle products he exported from New Zealand. The company started making infant milk powder in New Zealand in 1904 and called the product *Glaxo*. Thus was born the Glaxo part of the business. The company made its first pharmaceutical product in 1924; it was *Ostelin*, a cod liver oil concentrate. In 1929 it was replaced by irradiated ergosterol and in 1932 this gave way to pure calciferol.

In 1935 Glaxo Laboratories became a limited company and in 1947 it swallowed up the parent—Joseph Nathan and Co.—and became a public company. During the war it made penicillin on a large scale and in July 1949 it began production of streptomycin. Today the company has over one

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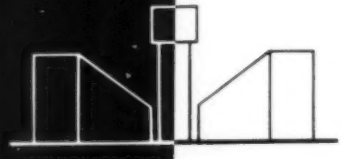

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hundred products in four broad groups: antibiotics; pharmaceuticals such as vitamin B_{12}, cortisone and calciferol; infant and other foods; and veterinary preparations. Its original research achievements include the isolation of vitamin B_{12}, the production of cortisone from hecogenin, work on whooping cough vaccine and on the modified Salk polio vaccine, and, in 1959, the introduction of griseofulvin, the oral anti-fungal vaccine. The company spends over a million pounds annually on research and development and employs 250 research staff at Sefton Park, Bucks., and Greenford, Middx.

In 1958 Glaxo merged with Allen and Hanburys and has further enlarged its scope by buying an interest in the Murphy Chemical Co. Ltd. (synthetic insecticides), by setting up a veterinary department and by entering the animal nutrition field.

Since the war Glaxo has made remarkable progress under the guidance and inspiration of its chairman, Sir Harry Jephcott who started with the company over 40 years ago. The acquisition of Evans is the latest but by no means the final chapter of the Glaxo story.

What is the chemical industry?

ANYONE talking about the chemical industry is confronted with a tricky problem of definition. As the chairman of I.C.I., Mr. S. P. Chambers, pointed out in a recent article, because of its diversity and the obscurity of its boundaries, the chemical industry is a difficult one to review and, partly as a consequence, its statistics are unsatisfactory. The official census definition of " chemicals and allied industries" includes a number of activities that do not really belong to the chemical industry, for instance, the manufacture of hoof meal and night lights. Thirty years ago a history written for the jubilee of the Society of Chemical Industry included such industries as linoleum, batteries, paint, soap, paper and glass. The only justification for including these activities can be that the history was one of chemistry in industry rather than of the chemical industry, and to this extent the title, *History of the British Chemical Industry*, was a misnomer.

A stricter classification was used by the Association of British Chemical Industry in its 1948 report on the chemical industry. For instance, it included the manufacture of fine and medicinal chemicals but excluded the manufacture of insecticides and pharmaceuticals.

In the first of three Royal Society of Arts lectures on the British chemical industry, Dr. James Taylor, a director of I.C.I., discusses these various definitions. He considers the A.B.C.M. definition to have arisen from the view that it is the business of the chemical industry to make chemicals but not to compound them. " There is a certain simplicity in this view," he says, " but it is too restricted in today's circumstances."

Dr. Taylor attempts to define his subject not by listing its activities but by applying a criterion. " The traditional industries deal with complex chemical processes which are still outside the quantitative knowledge and control of present-day chemistry. The chemical industry proper deals with relatively simpler chemistry which is fairly completely elucidated and quantitatively understood."

" Simple chemistry "—the layman, contemplating the vast achievements and esoteric installations of the chemical industry, must be startled by that description. To him there is nothing simple and little that is even comprehensible about its work. But within his own body chemical processes are at work producing substances of a complexity that baffles the most brilliant chemists. Nature, through humble microbes, produces molecules like those of penicillin and streptomycin that tax our understanding to the utmost. Even the most modern computers have millions of channels fewer than exist in man's brain. Industries based on natural chemistry, such as fermentation, agriculture and leather, may be assisted by science, but they are still arts and crafts. Of course, these situations are not static and are constantly changing as the chemist gradually advances the frontiers of his knowledge of that which can be measured and understood. But few will disagree with Dr. Taylor's view that the distinction between industrial chemistry and chemical industry must continue to be that the latter is primarily concerned with making chemical compounds by synthetic routes which can only be established through quantitative chemical science.

Arthur Reavell retires

ONE of Britain's pioneer chemical engineers is at last giving up the daily grind for the pleasures of his Kentish garden. J. Arthur Reavell, 88 not out, has retired from the chairmanship of his company, Kestners, after seeing it safely and successfully through its first half-century of growth and achievement. In fact it is 53 years since Reavell met Paul Kestner and obtained from him the rights to exploit his climbing film evaporator in the British Empire, with the proviso that any company Reavell might form would have the name Kestner in its title. Since then the company has formed South African and Australian subsidiaries.

Reavell has been chemical engineering consultant to various Indian States and to the famous Tata company. He is the inventor of Keebush chemical engineering plastic. In the midst of his busy professional life he has found time to play a full part in the engineering life of Britain. He was a founder member of the Institution of Chemical Engineers and its president 30 years ago. He has served on professional, educational and government committees and has helped establish chemical engineering standards.

He is well known in South Africa, where he spends some time each year. His interest in education there led to the Witwatersrand University naming their new chemical engineering laboratory after him.

Catching them young

COMPETITION has always been fierce for good jobs, but once it was always the individual who had to publicise himself and create the right impression. Now, with the vast expansion in industry and competition among firms being stronger than ever, the position has completely changed. To attract the right men to the right jobs more and more firms are using the arts of publicity. To look at any daily paper and scan the situations vacant pages is proof enough of this fact—not only are tempting salaries offered but also much is made of an applicant's chances of promotion, his working conditions and his pension prospects.

The new recruiting era has ushered in the glossy brochure and publicity film. We have seen several of these lately and in each the emphasis is on selling the career to the potential recruit.

Albright and Wilson Ltd. and the Society of Instrument Manufacturers' Association both make the point in their recruiting brochures that theirs are rapidly expanding industries which offer exceptional opportunities.

A new idea by Boots is the circulation of their guide among careers masters and mistresses, youth employment officers and others in the Nottingham area. It is described as "essentially a book of reference." A novel feature is the complementary set of seven advisory pamphlets which school children can take to discuss with their parents.

A most elaborate attempt to attract recruits to the chemical industry was made recently at a Careers Masters' Convention run by the Shell Chemical Co. and the Public Schools Appointments Bureau. The 60 members of the convention were given an appraisal of the organisation and function of the chemical industry in four lectures and were then shown various plants and laboratories to give them as wide a view as possible.

The most thought-provoking recruiting film we have seen is an I.C.I. production called "New Minds for a New World." This could have been a straightforward propaganda film, and as such could have served as an antidote to the claim that only the arts can provide a sound, civilised foundation for a full life.

Instead the film uses the unscripted interview technique in an attempt to put across what young people at schools and universities think about science and scientists, as well as hearing the views of the potential employer in industry.

The result is a film which does not come to any simple tidy conclusions. It illuminates the thoughts and feelings of people in the academic and industrial worlds, and it is a stimulus to further discussion. This film may achieve two useful purposes—it may make young people sufficiently interested to search more fully into the possibilities of a scientific career, and it may also show industry something of what the people it hopes to attract think of their potential employers.

Poaching on the poachers

AMERICAN firms have been recruiting British scientists and technologists for work in the United States for years, a traffic that has not met with approval everywhere. M.P.s tend to get rattled about it. Is it not scandalous, they protest, that the Americans should poach on our sparse crop of scientists, raised painfully and mostly at the State's expense? Usually this argument is used to belabour the Government into spending still more on technical and university education so that the crop of scientists multiplies and the Americans, presumably, have a richer choice. Well, it may be scandalous, but we have not yet decided that because a man possesses special skill and knowledge he should be deprived of the freedom to work where he chooses. And so we have got used to American poaching and become accustomed to those lavish advertisements offering fabulous rewards to solid state physicists willing to work in Ohio and to gas dynamacists who feel drawn to places like Schenectady or Peoria.

Now the poachers are themselves being poached upon. In *Chemical and Engineering News* we see a large advertisement offering a situation in fundamental research to a scientist trained in classical physics, applied mathematics, fluid dyanamics, etc., at Levington Research Station, Suffolk, England. The bold poachers are Fisons Fertilisers Ltd. Good luck to them. So long as there's a shortage of British scientists, may other firms follow their example and redress the balance of the old world with recruits from the new.

Dutch chemical engineering

ALMOST unnoticed the Dutch chemical industry has been expanding at a phenomenal rate. In 1959 Dutch chemical exports totalled £150 million compared with an average pre-war figure of £9 million. The production of this industry in 1959 was valued at £310 million. Hand-in-hand with development of the chemical industry there has been a growth in the plant construction industry. Before 1939 the Dutch engineering industry specialised almost entirely in shipbuilding and specialised plant like sugar mills; hence there was relatively little experience in design and construction of chemical plant.

The stimulus for creating a chemical plant construction industry in Holland came partly as a result of the Royal Dutch Shell Group decision in 1946 to enlarge their refinery and order as much equipment as possible from the local engineering industry. It was recently announced that a new association called "Netherlands Apparatus for the Process Industry" (N.A.P.I.) is now to be formed to provide a closer co-ordination between the chemical process and plant industries in Holland. This association will be somewhat similar to the industrial research associations sponsored by both D.S.I.R. and industry in this country.

The sensible outlook of the Dutch chemical industry has largely contributed to the sound basis

for technology and engineering that exists in Holland nowadays. Schools like the Technical University at Delft are good examples of Holland's determination to forget its colonial past and concentrate on becoming technologically self-sufficient. Thus the ties between industrial and university research are very close, and in fact most university technology depatments are lavishly endowed by the Dutch chemical industry, which as a consequence is almost entirely staffed by Dutch-trained engineers and technologists. The establishment of N.A.P.I. is another proof that Holland is taking chemical plant design and construction as seriously as other chemical engineering problems.

Hungary raises herb output

COMMERCIAL cultivation of medicinal herbs was started by Hungarian farmers at the end of the last century, and today production in co-operative and State farms is increasing year by year. Both the wild and the cultivated herbs are processed by a co-operative company, *Herbaria*, and the products are now being exported to some 25 countries.

The collection and introduction, cultivation and improvement of herbal plants is the work of the Institute for Research on Medicinal Plants, which was founded in 1915. Besides carrying out agricultural research, the Institute is developing machines and implements for the mechanisation of the industry. The Director of the Institute, Mr. Tetenyi, has reorganised its work and has secured a 200-acre farm for field experiments.

Plant introductions have been very successful and the cultivation of French lavender and English spearmint has considerably increased the exports of essential oils. Of all the medicinal products, three most important are ergot, opium and the camomile.

Formerly wild ergot was laboriously collected in the rye fields, and this made it scarce and expensive. Large scale production became possible through the work of one of the research workers of the Institute, Dr. Bekesy, who demonstrated that rye can be infected artificially by inoculating the plant at the time of inflorescence with the spores of the ergot fungus, using a hypodermic needle.

This, too, was rather laborious, so he next produced a machine for treating whole heads of rye in the field. It consisted simply of two parallel rolls, one rubber-covered and the other having sharp teeth. The teeth were dipped into the inoculant and several ears were infected simultaneously by drawing the heads of corn between the rolls. The prototype machine was hand-operated, but a motorised machine is now being developed.

Camilla hungarica is a Hungarian drug with a world-wide reputation because of its high active material content, due to the very favourable climate. The wild camomile grows over vast areas; it can be cultivated even on poor, sodic soils and also in rotation with rice. A suitable harvester has not yet been found. In the U.S.A. there is a harvester for pyrethrum, which is a similar crop, though much taller than camomile, and so is easier to cut and harvest. No doubt a suitable machine for the camomile will be found and two prototypes are already under test.

Solanum aviculare is a new plant recently used for the production of medicinal hormones; it was introduced by the Institute and its cultivation is being extended. The seedlings are planted with tractor-drawn implements on which the operators sit.

Digitalis lanata, a foxglove, is a new variety which contains glycoside " C," which is missing in the common *Digitalis purpurea*.

Although many drugs are produced synthetically, natural substances produced from herbs are indispensable and increasing demand can only be met by large-scale production. The Hungarians realise that mechanisation of cultivation and harvesting are essential for the development of the herb industry.

Americans praise British machine

ULTRASONIC emulsification has become an accepted processing technique, and it is difficult to realise that it is only in the past ten years or so that reliable equipment has been available. We were reminded of the relative novelty of using an ultrasonic generator to produce emulsions by a paper in the *Journal* of the American Pharmaceutical Association (1960, **49**, (7), 482). So far as we know this is the first comparative evaluation of the performance of different types of ultrasonic homogeniser. Three machines were evaluated and for further comparison a colloid mill was included in the trial to represent conventional emulsifying equipment. Twelve 25% v/v oil-in-water emulsions were studied, each being processed in each of the four machines for 2½, 5, 10 and 15 min. One machine stood out above the rest, giving emulsions superior to those produced in any other machine. Like the other machines it is American built, but unlike them it is of British origin. It is the Minisonic homogeniser made by the Sonic Engineering Corporation. The president of this company is Mr. E. C. Cottell who, with Mr. John E. Goodman, invented the principle of the Rapisonic and Minisonic machines some 12 years ago. Mr. Cottell emigrated to the United States about four years ago to head Sonic Engineering, which is associated with Ultrasonics Ltd., of Yorkshire.

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An operator removing influenza virus from fertile eggs.

Evans' New Virus Vaccine Unit at Speke

EGG AND TISSUE CULTURE BUILDINGS

THE manufacture of vaccines and antitoxins is part of the long history of Evans Medical Ltd. Hitherto these products have been made at the Evans Biological Institute at Runcorn, Cheshire, which has been established for over 50 years. The company have now built a new virus vaccine unit on part of their main factory site at Speke, Liverpool, there being no longer room for expansion at Runcorn.

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Approximately 70% of the buildings will be air conditioned to prevent the escape of infected air. For this reason most windows are double glazed and sealed, and each building is separately air filtered. The quadrangle layout provides a physical barrier against cross-contamination. All workers have to change completely for work and each building is equipped with showers and changing rooms. Each building is self-contained and staff may not move from one building to another without changing clothes.

All virus wastes are steam sterilised before discharge. There are two separate drainage systems, one for soil and rainwater and the other for virus wastes. The effluent from the virus drains is first collected into a 10,000 gal. underground tank. At the end of the day it is pumped into a sterilising tank of equal capacity above ground so that the lower tank is ready for the next day's effluent. After autoclaving the virus wastes are discharged to the main drains as harmless liquid.

The whole unit is isolated, with a chain link fence round the perimeter to prevent stray animals entering.

These precautions against contamination and accidents are expensive. Coupled with the extensive stainless steel equipment—including a freeze drying plant—they have increased expenditure on the unit considerably.

The first product to be made is canine distemper and hepatitis vaccine and this will be followed by influenza vaccine. The production of other virus vaccines is planned.

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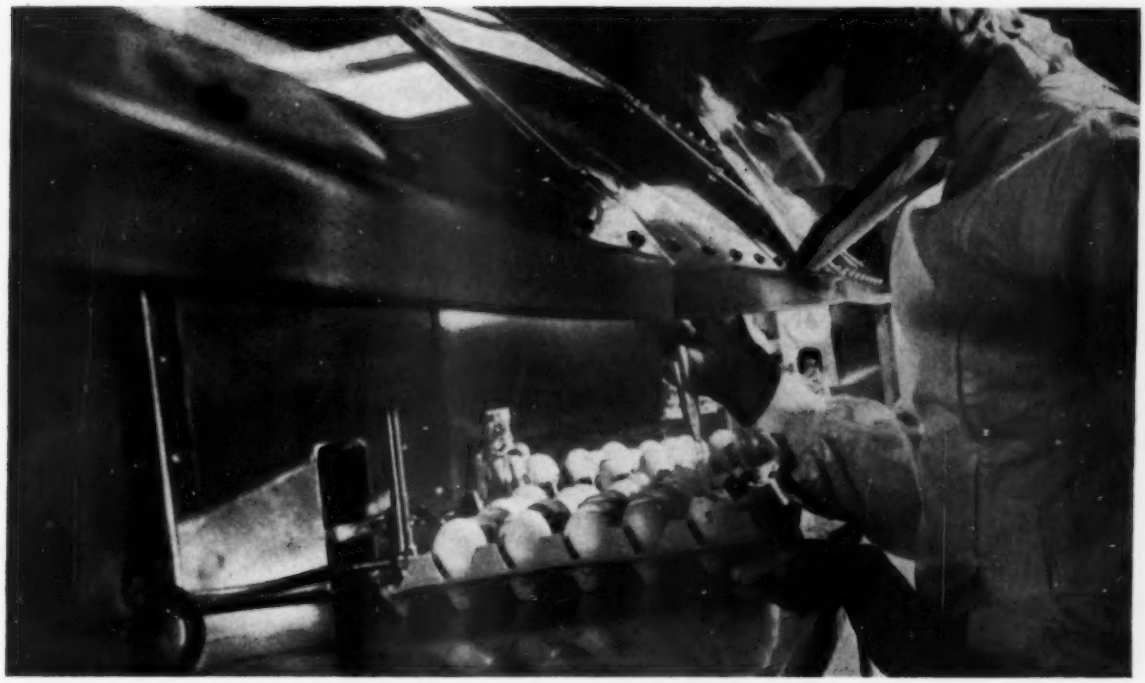

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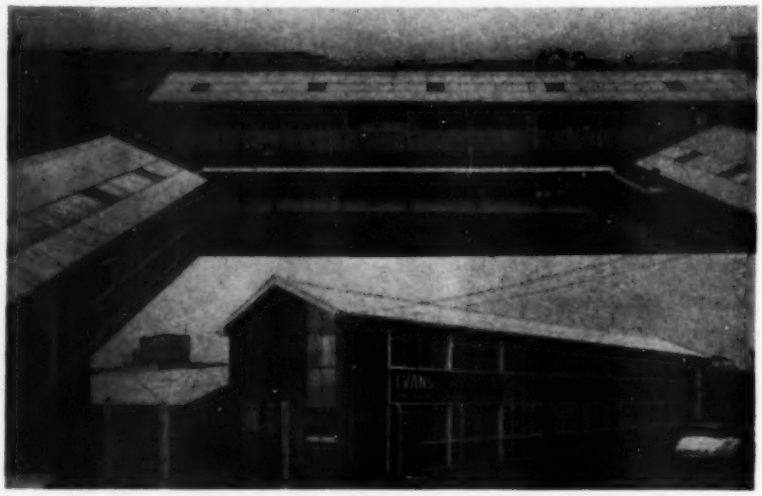
Canine distemper and hepatitis

EVAN'S NEW VACCINE UNIT

Top: **Rear of the buildings showing the service and development unit and tissue and egg culture production buildings. Inset, front view.** *Middle:* **Loading bottles for sterilisation into an autoclave.** *Bottom:* **Washing and sterilising department.**



vaccine is commonly a vaccine of mixed egg and tissue culture origin, but recent development has enabled the attenuated distemper strain to be grown in tissue culture, providing a vaccine of better immunising power and with a lower protein content. The Evans Medical vaccine is of this type. Influenza will be a conventional vaccine produced from the allantoic fluid (egg) cultivation of influenza.

The Egg Unit is equipped to handle batches of thousands of eggs at one time; throughput could be stepped up by the pre-incubation of eggs before they are brought to the Unit. As far as possible the larger-scale handling of eggs has been simplified so that it can be largely done by unskilled labour. The procedure followed with eggs depends on the virus being grown, but briefly the pattern is:

(1) Pre-incubation to obtain an embryo of the desired size.
(2) Candling to determine fertility.
(3) Inoculation with virus.
(4) Re-incubation to allow virus growth.

When the virus has multiplied to the required stage the eggs are passed to the harvest room where the appropriate fluids or tissues are removed by teams of 12 girls.

The Tissue Unit is designed to handle either cells freshly prepared from animals, such as pig kidney used for hepatitis virus growth, or cells from continuous cell lines such as the carcinoma cell HeLa.

Cell suspensions can be prepared either in bottles or in tubes and these are incubated until sheets of actively growing cells are formed. On to these sheets virus is inoculated and allowed to grow for a number of days, usually between four and seven, at which time the cells and the fluids are pooled in large containers and are clarified either by centrifugation or by filtration.

The final pools of virus material are tested for virus content and providing this is satisfactory can then be made into a vaccine.

The freeze dryer is in the main

(*Continued on page* 74)

Carbohydrates in the Chemical Industry

2. Starch, Cellulose and Derivatives

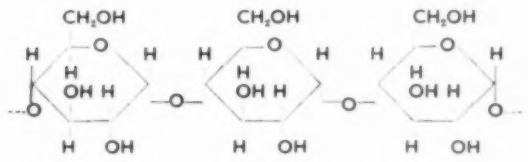
By Greville Machell, B.SC., PH.D.

In this article Dr. Machell describes the chemistry of starch and cellulose. He then deals with the derivatives of cellulose and their applications in the textile industry, in plastics and in detergents. He concludes with a section on alginic acid and pectin, which are finding increasing use in pharmaceuticals, cosmetics and food products. In the first article published in December the author covered simpler carbohydrates and derivatives of glucose and sucrose. The final article will deal with carbohydrates in fermentation processes.

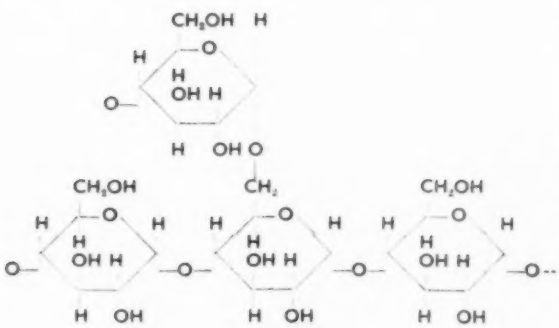
STARCH is the typical reserve polysaccharide of land plants, which synthesise it from glucose, fructose and other simpler carbohydrates. Starch is actually a mixture of two polysaccharides known as amylose and amylopectin, the relative amounts of the two components varying widely from plant to plant. In general, however, the amylopectin part predominates.

Starch is extracted commercially from wheat, rice, maize, potatoes, etc., by leaching with water and removing husks and fibrous matter. The product is employed on a large scale as a size, filler and adhesive. Large quantities are also used in the production of glucose by acid hydrolysis and in the fermentation industries.

It is now necessary to examine in more detail the chemical structures of the two components of starch,



Amylose
(XV)



Amylopectin
(XVI)

amylose and amylopectin. Both are built up from glucose molecules only, but the architecture of the two molecules is quite different. To explain the difference between the two and to enable us to distinguish them from other polysaccharides such as cellulose, the precise chemical structures are given in XV and XVI. It is readily seen that amylose is a linear polymer, while amylopectin is branched, there being many points of branching in the complete molecule.

Average molecules of amylose and amylopectin contain several thousand glucose units.

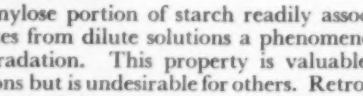
As a result of their different spatial arrangement, the two molecules would be expected to show quite different physical behaviour, and this has been confirmed by examining pure amylose and pure amylopectin from starch. The separation can be achieved in three ways. The first depends upon the fact that amylose forms crystalline, water insoluble, complexes with a number of aliphatic alcohols, notably *n*-butanol. Starch is made into a dilute paste with water, butanol added, and the crystalline precipitate removed. After a second precipitation in the same way, the amylose is virtually pure, and amylopectin is recovered from the mother liquors. In the second approach[13] the starch is treated with cold, dilute sodium hydroxide, in which amylose is soluble and amylopectin insoluble. Centrifugation settles the latter, and as it is highly swollen in alkali, the amylose is completely excluded. Recently, farina starch has been successfully separated into amylose and amylopectin by a salting-out procedure. The starch is cooked with a buffered magnesium sulphate solution at 160° for about 15 min., and the solution then rapidly cooled to 70°. Farina amylose precipitates out completely, while the amylopectin fraction is recovered from the mother liquor by subsequent cooling to 20°. Both components are now available commercially.

The reason for the commercial interest in this separation lies particularly in the desire to obtain pure amylose on a large scale. As the amylose molecule is linear it should form strong fibres, and it is therefore of potential interest to the textile industry. Uses for amylose have also developed based on its excellent film-forming properties.[14] Present patents refer to the application of

amylose in the manufacture of skinless sausages, while future developments are expected in the paper industry.

Modified starches

The amylose portion of starch readily associates and precipitates from dilute solutions a phenomenon known as retrogradation. This property is valuable in some applications but is undesirable for others. Retrogradation can be arrested by preventing the amylose molecules from associating and this is achieved in two ways. Firstly, the starch may be oxidised with sodium hypochlorite when a number—say 1 in 50—of the primary alcohol (CH_2OH) groups of the individual glucose units are oxidised to carboxylic acid (COOH) groups. Secondly, the starch may be treated with ethylene oxide resulting in the introduction of hydroxyethyl groups. (XVII)



(XVII)

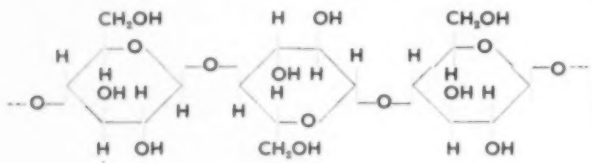
The presence of an average of about one hydroxyethyl group per 20 glucose units is quite sufficient to prevent retrogradation.

Both these products have excellent film-forming characteristics and are used extensively in the sizing of cotton, rayon and several of the synthetic fibres. The more highly oxidised starches are indispensable to the paper-coating industry.

In recent years geneticists have succeeded in raising the amylose content of corn starch from 25 to over 80%. This development, in conjunction with a convenient fractionation procedure to remove the remaining amylopectin, may lead to large-scale uses for amylose and its derivatives in the future.

Cellulose

Cellulose is the principal constituent of the cell-walls of the higher plants, and is again a polymer of glucose. As in amylose, the glucose molecules are united in a linear manner, the only difference lying in the spatial disposition of the glucose units. (XVIII)



(XVIII)

Cellulose varies in purity according to its origin. Raw cotton is almost pure cellulose, but wood contains only about 50%. Cotton fibres vary in length, the longer ones being spun into thread, while the short ones—linters—are used for making cellulose derivatives. The cellulose in wood is isolated on a very large scale throughout the world by a number of processes specially designed to handle different types of wood, and to produce cellulose of differing purity. In all the processes the prime object is to remove lignin and other unwanted components while at the same time preserving as much as possible of the original cellulose. This is achieved by cooking the wood with an alkali or alkaline earth bisulphite under pressure or with a mixture of sodium hydroxide and sodium sulphide (Kraft process). Certain woods give poor results by these procedures, and these may be cooked with sodium hydroxide alone, or first subjected to acid hydrolysis and then cooking with sodium hydroxide.

All these processes remove the lignin satisfactorily, but the other original components of the wood—pentosans—are not efficiently removed by the Kraft process. However, the presence of pentosans is desirable for paper making, and Kraft pulps are therefore very suitable for this end use. Pulps destined for rayon and cellulose derivative manufacture must be as free from pentosan as possible; the product from the other two processes fulfils this requirement.

Viscose rayon

Initially, viscose rayon was made from cotton linters, but is now made exclusively from wood pulp. The whole object of the process is to get the cellulose into solution, and then precipitate it again as a continuous fibre. This is done by steeping the wood pulp in strong sodium hydroxide, when soda cellulose is formed; after pressing out the excess alkali, the material is aged, and then treated with carbon disulphide to give cellulose xanthate. In principle the reaction taking place is simple; if we write soda cellulose as RONa we have:

The xanthate is soluble in sodium hydroxide, and the solution is pumped through spinnerets into a coagulating bath containing sulphuric acid to decompose the xanthate and regenerate the cellulose. Numerous other constituents are added to the coagulating bath to increase the tensile strength and otherwise modify the resulting fibre. The higher the purity of the original wood pulp, the higher the tensile strength of the resulting fibre. Pulps containing upwards of 95% cellulose and only about 1% pentosan are used for the manufacture of the so-called high-tenacity rayon, employed for instance in car tyres.

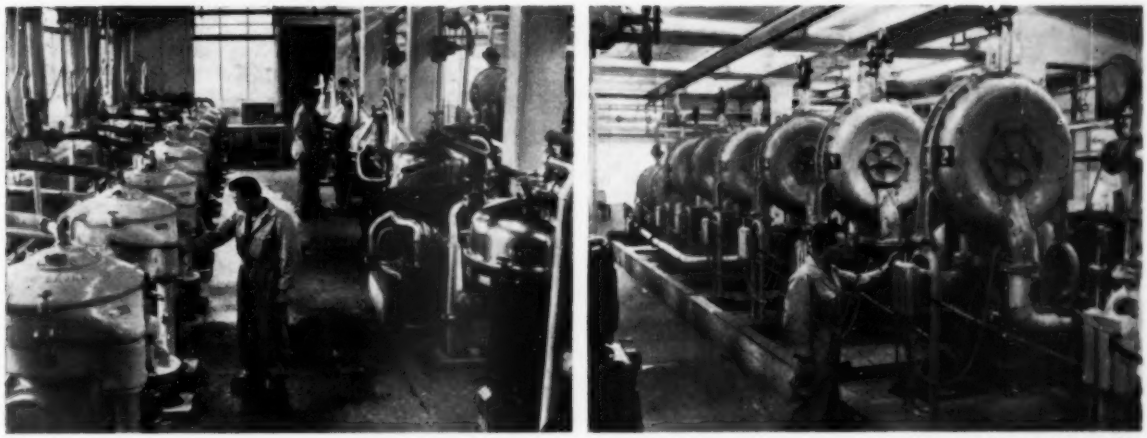
Transparent cellulose film is also produced by the viscose process, the xanthate solution being extruded through a narrow slit into the coagulating bath, thus producing a film instead of a fibre.

Bemberg rayon

Cellulose itself is soluble in a number of chemical reagents including cuprammonium hydroxide. Bemberg rayon is made by dissolving cotton linters or a highly purified wood cellulose in this reagent, and the cellulose regenerated by spinning into an acid coagulating bath.

Cellulose esters

Cellulose esters, particularly the acetates, are of great industrial importance. The general method of preparation is to react a very pure cellulose with the appropriate acid anhydride in the presence of a catalyst. A mineral acid catalyst such as sulphuric acid is generally used, but the patent literature contains several examples of other catalysts. Inspection of the formula of cellulose given above reveals the presence of three hydroxyl groups per glucose unit, and cellulose therefore forms a triacetate on treatment with acetic anhydride. This triacetate is soluble in a mixture of methylene chloride and methanol, and it is dry spun from the latter solvent mixture. Dry spinning is carried out by forcing a solution of the triacetate through a spinneret into a hot atmosphere, where the solvent rapidly evaporates. Although the triacetate has been known for many years, it is only in



(Courtesy of Brown and Polson Ltd).

Left: **The manufacture of starch. Centrifuges on the left are separating starch from gluten, the latter then going to the machines on the right for de-watering.** *Right:* **Starch is thoroughly washed free of protein in this nine-stage hydroclone system. Wash water runs through countercurrent to the starch.**

the last few years that difficulties in its manufacture have been overcome, and the textile fibre from it has become well established.

Early disappointments with the triacetate led to investigation of a less highly substituted derivative and the ultimate commercial production of the so-called secondary acetate. This is made by a partial hydrolysis of the triacetate and actually contains an average of 2·4 acetyl groups per glucose unit. The product is readily soluble in acetone from which it is dry-spun.

Cellulose acetates have applications in other fields beside textiles. They are used in photographic films, transparent sheeting, plastic compositions, and surface coatings.

Cellulose propionate and butyrate are made in a similar way and are used on a small scale in the plastics field. Of much greater interest are the mixed esters, cellulose aceto-propionate and aceto-butyrate, which are made by esterifying the cellulose with an appropriate mixture of the two anhydrides or with one anhydride and one acid. These mixed esters have more attractive physical properties than the simple propionate or butyrate, and are produced more readily. They are used extensively in the manufacture of plastics, films and surface coatings.

A number of esters of cellulose with unsaturated aliphatic acids have been described. In general, these may be prepared in an analogous manner to cellulose acetate; thus treatment of cellulose with crotonic anhydride and an acid catalyst gives cellulose tricrotonate. Mixed acetate-crotonates and similar compounds have also been prepared. The interest in these compounds lies in their ability to be cross-linked by heating, by exposing to ultraviolet light or by treating with a diamine which reacts with crotonyl groups from adjacent molecules.

Cellulose may be esterified by one or both carboxyl groups of dibasic acids, but only products of the first group—the acid esters—are of commercial interest. Dicarboxylic acids which have been used in preparing these esters include succinic, adipic, maleic and phthalic acid. More useful are mixed esters containing acetate groups also, and these may be prepared by treating cellulose already partially esterified by acetic anhydride with, say, phthalic anhydride in the presence of a mineral acid, or a tertiary base such as pyridine, or sodium acetate. These acid esters are soluble in a wide range of organic solvents and by virtue of their free carboxyl groups, in dilute aqueous alkali. They may therefore be employed commercially for the application of water insoluble surface coatings or sizings, which are later removed by treatment with dilute aqueous alkali.

Considerable academic and potential commercial interest attaches to esters of cellulose with methanesulphonic and *p*-toluenesulphonic acid. Treatment of these esters with aliphatic primary ($R'NH_2$) or secondary amines results in the introduction of nitrogen atoms directly attached to the carbon atoms of the cellulose molecule (ROH) thus:

$$ROH + CH_3SO_2Cl \longrightarrow ROSO_2CH_3 \xrightarrow{R'NH_2} RNHR'$$

The aminised cellulose is soluble in dilute acids.[15]

Several methods have been devised for producing esters of cellulose with amino-acids either directly or indirectly. The most promising of these is one recently published on the preparation of cellulose acetate succinamates. These are prepared with remarkable facility by treating cellulose with a mixture of acetic anhydride and the succinamic acid in the presence of a mineral acid catalyst. It appears that the most useful succinamic acid is N,N-dimethyl-succinamic acid, $(CH_3)_2NCOCH_2CH_2COOH$, which is readily prepared from succinic anhydride and dimethylamine. The products are readily soluble in acetone, from which fibres may be spun. These fibres, with their basic groups have interesting dyeing properties.

Inorganic esters

By far the most important cellulose derivative of this group is cellulose nitrate often, and erroneously, termed nitrocellulose. Originally the raw material for the manufacture of cellulose nitrate was cotton linters, but in recent years the use of highly purified wood cellulose has become well established. The cellulose is generally treated with a nitric acid/sulphuric acid/water reagent under carefully controlled conditions until the required amount of nitration has taken place. The product is then carefully washed to remove the nitrating reagent and to

hydrolyse the small number of sulphate groups present. Inadequate washing and hydrolysis lead to subsequent instability of the product, which could have disastrous consequences. The degree of nitration decides the end use of the cellulose nitrate. Products containing a number of nitrate groups approaching the theoretical maximum (three per glucose unit) are used as explosives, while those for use in plastics, lacquers and cements require about two-thirds of the cellulose hydroxyl groups to be converted to nitrate.

Reference has already been made to the introduction of sulphate groups into cellulose during the manufacture of cellulose nitrate. Cellulose sulphate has been made on a commercial scale by treating cellulose with a mixture of sulphuric acid and *iso*propyl alcohol. The product contains about one sulphate group per glucose unit, and was marketed as the sodium salt. This material is quite soluble in water and was recommended for use as a thickening agent and size.

Cellulose phosphate has also been prepared. Introduction of phosphate groups into cellulose, notably cotton cloth, results in a degree of flame-proofing.

Cellulose ethers

Many ethers of cellulose have been described, but only four have found extensive application to date. Preparation of these ethers is a simple matter, the process used being an example of the well-known Williamson ether synthesis of organic chemistry. Cellulose is first converted to soda cellulose (RONa) with strong sodium hydroxide solution, and then treated with the appropriate alkyl chloride (CH_3Cl or C_2H_5Cl). (XIX)

$$RONa + CH_3Cl \longrightarrow ROCH_3 + NaCl$$

methyl cellulose

(XIX)

or ethylene oxide. (XX)

$$ROH + CH_2CH_2 \longrightarrow ROCH_2CH_2OH$$

(via the epoxide, O)

Hydroxyethylcellulose

(XX)

or monochloracetic acid. (XXI)

$$RONa + ClCH_2COOH \longrightarrow ROCH_2COOH + NaCl$$

Carboxymethylcellulose

(XXI)

The properties of the ethers produced depend upon the number of substituent groups in the product. Commercial methyl cellulose contains from 1·5 to 2 methoxyl groups per glucose unit and is soluble in water. It is used extensively as a dispersing agent, thickener, size and adhesive, and as it is physiologically inert, finds widespread application in food products.

Ethyl cellulose is generally made with more than two ethyl groups per glucose unit for use in plastics. Hydroxyethyl ethers still contain the same number of hydroxyl groups as the original cellulose, and are used as thickening agents.

Carboxymethyl cellulose (CMC) is generally marketed as the sodium salt and this is prepared directly by using sodium monochloracetate instead of the free acid. It is soluble in water and is well known as a constituent of adhesives for wallpaper, and detergents.

Numerous other cellulose ethers are made commercially on a small scale for specialised uses. Among these are various amino-ethers, which are made in the conventional manner employing amino-substituted alkyl halides such as aminoethyl chloride, $NH_2CH_2CH_2Cl$, and diethylaminoethyl chloride, $(C_2H_5)_2NCH_2CH_2Cl$. These compounds have basic properties and have applications as ion-exchangers and in chromatography. In the presence of alkaline catalysts, acrylonitrile will cyanoethylate the hydroxyl groups of cellulose to give the cyanoethyl ether. (XXII)

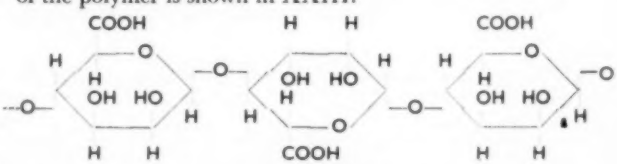
$$ROH + CH_2 = CHCN \longrightarrow ROCH_2CH_2CN$$

(XXII)

At the present time cyanoethyl cellulose is not available commercially, but cotton cloth treated with acrylonitrile as above is undergoing development in the U.S.A. The treated cloth contains about 0·5 cyanoethyl groups per glucose unit and has a much enhanced resistance to rotting, heat and wear.

Alginic acid and pectin

Alginic acid is an acidic polysaccharide found in seaweed and isolated therefrom commercially in several countries, including the United Kindom. The building unit of alginic acid is mannuronic acid, and the structure of the polymer is shown in XXIII.



(XXIII)

It is seen to bear a resemblance to amylose and cellulose, the most important difference being the replacement of the primary alcohol (CH_2OH) group by a carboxylic acid (COOH) group.

Alginic acid and its salts are finding numerous applications in industry. Sodium alginate acts both as a thickener and emulsifier, being used widely in food products, particularly ice cream, and in pharmaceuticals and cosmetics. Wide use is found for alginates in paper and textiles, the main use in the latter depending upon the fibre-forming properties of calcium alginate. Alginate fibre serves as a " scaffolding " fibre during weaving and is then removed from the finished fabric by washing in alkali.

Pectin has a structure very similar to that of alginic acid, a notable difference being that most of the acid groups are esterified by methyl alcohol. It is extracted from the juice of unripe fruits such as apples and is used in the manufacture of jams and other food products.

Synthetic polysaccharides

Over the past few years there has been considerable industrial interest in the production of synthetic polysaccharides from glucose and sucrose. These are prepared by treating the simple carbohydrate with acids under carefully controlled conditions which lead to polymerisation. In one process[17] starch is converted to glucose by acidic hydrolysis, the *p*H adjusted and the syrup concentrated. After addition of a small amount of formaldehyde the product is dried and the resulting powder heated, when polymerisation takes place. The product is water soluble and is expected to have applications in the manufacture of adhesives.

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Research on Immunological Products in West Germany

The Work of the Paul Ehrlich Institute and its Associated Institutes

By Prof. Dr. G. Eissner*

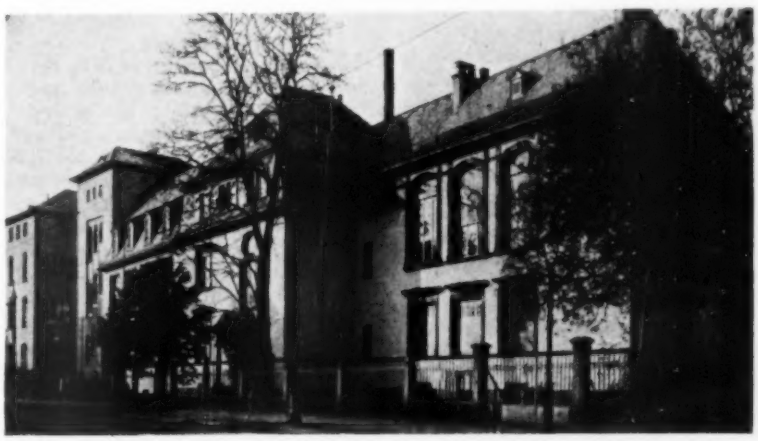
The central testing station for all immunological preparations produced in West Germany is the Paul Ehrlich Institute at Frankfurt-on-Main. This institute is named after its first director, the father of modern chemotherapy. The Ehrlich tradition of distinguished fundamental research is continued at the institute and the two associated institutes, the Georg Speyer Haus and the Ferdinand Blum Institute. Apart from their work of testing and control they carry out research on international standards, on the chemotherapy of tuberculosis and on polio vaccines.

TOWARDS the end of the last century important medical discoveries were made and some new medical and biological research institutes attained international recognition. One of them, the Royal Institute of Experimental Therapy, was founded in 1896 in Berlin-Steglitz. In 1899 the institute was transferred to Frankfurt-on-Main and in 1919 named the Federal Institute of Experimental Therapy. The first director of this research centre was Paul Ehrlich and in 1947 his name was given to the institute.

The chemotherapy research institute, the Georg Speyer House, well known to physicians of all countries as the birthplace of modern chemotherapy, is a private foundation. Professor Ludwig Darmstaedter was deeply interested in the research work of Paul Ehrlich. He induced his sister-in-law, Franziska Speyer, the widow of a Frankfurt banker, to make a generous endowment which made it possible to establish a new building for Ehrlich's research. It was opened in 1906.

In 1911 the Biological Society of Frankfurt founded the Biological Institute and entrusted its direction to Prof. Ferdinand Blum, the well-known endocrinological pioneer. In 1950 the institute was named the Ferdinand Blum Institute of Experimental Biology.

Under the guidance of Ehrlich research in the Ehrlich Institute and the Georg Speyer House was crowned with success. There was the side-chain theory which permitted an interpretation of immuno- and chemotherapeutic reactions. And there was also the introduction of the "special standard principle" into the evaluation of diphtheria antitoxin. For this work Ehrlich received the Nobel Prize in 1908. Of high scientific and practical significance was another discovery of this time: the elucidation of the atoxyl structure by Ehrlich and Bertheim in 1906. Uhlenhuth introduced the atoxyl structure into the therapy of syphilis. Ehrlich, the father of modern chemotherapy, modified the structure of atoxyl and after many experiments he produced compound "606" (Salvarsan and Neosalvarsan), which proved highly effective against spirochetoses, above all syphilis.



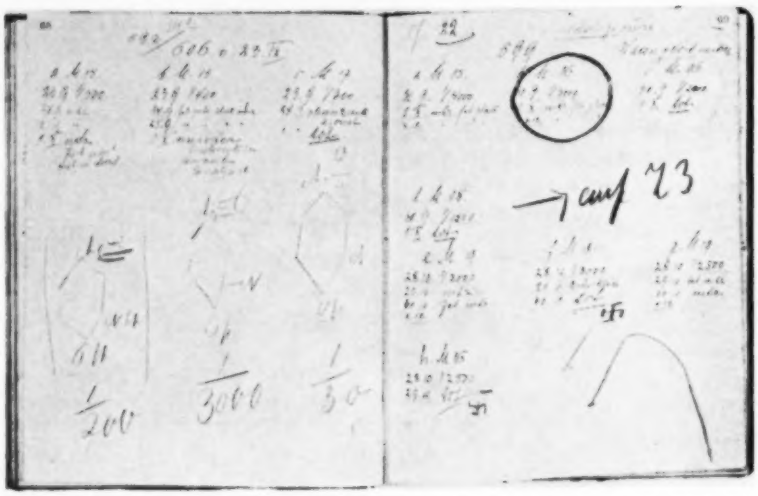
(*Left*) **The Paul Ehrlich Institute and** (*right*) **the Georg Speyer House. These are not the original buildings in which Ehrlich worked. These were destroyed during the war and the present buildings were erected between 1949 and 1953.**

Ehrlich's successors were Kolle (1917-1935) and Otto (1935-1948), and they were able to continue his work despite setbacks. During the second World War the Ehrlich Institute was destroyed; rebuilding began in 1949 and was finished in 1953. Thanks to Dr. Stein, the former Minister of Culture of Hesse, and the initiative of Prof. Dr. Prigge, the present director of the three institutes, Ehrlich's work was carried on. These two men were successful in including the institutes in the "Königsteiner Abkommen" of the ministers of culture and finance of the Bundesrepublik, thus securing a sound financial basis for their research work.

To describe the work of the three institutes today we must begin with

* Paul Ehrlich Institute.

the work of the present director, Prof. Dr. Prigge, who took up the post in 1949. His aim is to guide the institutes in the Ehrlich tradition. Aside from official functions of testing biological products (antitoxins and vaccines) for conformity with regulations, Prigge undertakes basic research in the different sectors of immunology. He has also done outstanding work in biometry. These studies made it possible to introduce his "general standard principle" for the evaluation of vaccines for active immunisation. His general standard principle, combined with mathematical and statistical methods, guarantees high reproducibility of results obtained in evaluating vaccines. His work stimulated further studies in this field.



Pages of history. Ehrlich's notebook opened at the pages on which he recorded the discovery of compound 606 (Salvarsan), thus opening the doors to modern chemotherapy.

Control of immunological products

The practical consequences of his work are shown by the official duties of the Paul Ehrlich Institute. It is the central testing station for the control of immunological products for West Germany. All these preparations are produced by private manufacturers but controlled by the government. The institute tests for safety, purity and potency. The following products are under control by law: diphtheria, tetanus, gas gangrene (*Cl. perfringens*, *Cl. ædematiens*, *Cl. septicum*), meningococcus, dysentery (Shiga) and erysipelas antisera; vaccines for active immunisation against diphtheria, tetanus, typhus, poliomyelitis, erysipelas and Newcastle disease; biological diagnostics (tuberculin, all types of test sera for blood group determination antigens and amboceptors for the diagnosis of syphilis); Salvarsan and Spirotrypan.

In addition, the institute is responsible for the storage and distribution of international standard preparations which serve as a reference in the potency test of antibodies, antigens and antibiotics. The standard compounds are continuously supplemented and their conformity with the original standard preparation is ensured by exacting calibration.

International standards

In collaboration with the Expert Committee for biological standardisation of the World Health Organisation (WHO) the German standard for diphtheria toxoid adsorbed was adopted as the international standard and the potency equivalent of one protective unit as defined by the Paul Ehrlich Institute was accepted as the international unit.

In the case of tetanus toxoid the equivalent of the protective unit as defined by the institute had already been accepted as the international unit in 1951. New work in producing and calibrating an international standard for tetanus toxoid adsorbed is in progress in collaboration with the WHO.

The swine erysipelas serum prepared by the Paul Ehrlich Institute was also adopted as the international standard, and the activity equivalent of one unit as defined by the institute was accepted as the international unit. Similarly, the international unit for syphilitic human serum corresponds to the German Reagin-unit. Recently the standard preparation of the institute for the evaluation of swine erysipelas vaccines, which was investigated in international collaboration was adopted as the international standard, and the potency equivalent of one protective unit as defined by the institute was accepted as the international unit.

The Ferdinand Blum Institute, founded in 1911 as the Frankfurt Biological Institute and named after its first director, the endocrinological pioneer, in 1950.

Tuberculosis research

Another primary field of research in which the three institutes led by the Georg Speyer House collaborate closely is tuberculosis. The introduction of concepts of the collective experiment and the acute infection in white mice into the methodology of chemotherapeutic research by Prigge in 1937 was a milestone. Of high theoretical and practical significance are the creation of an exact method for the evaluation of tuberculin, the introduction of purified tuberculin (developed in collaboration with Farbwerke Hoechst) for diagnostic purposes in human medicine, and the development and introduction of a standard cattle tuberculin, the "Rinder-Einheits-tuberkulin" (Meyn and Prigge), for diagnostic purpose in veterinary medicine. Thanks to these products the fight against cattle tuberculosis in West Germany was most successful. The main aim of tuberculosis research is to investigate both the immunobiology of the disease and

(*Continued on page 74*)

Methods and Machines for Making GELATIN CAPSULES

By G. Müller

Enormous quantities of gelatin capsules are now used for human and veterinary medicines. They are being used for many other products, from cosmetics to lighter fuel and food ingredients. In this article the author ranges from semi-automatic production methods to the latest integrated automatic machines developed by the Scherer organisation.

GELATIN capsules were invented 125 years ago by the Parisian apothecary Mothes. He dipped small leather sacs into gelatin solution and stripped the resultant skin after cooling and then filled it with the medicament. After that it was sealed with a few drops of gelatine solution.[1] For small-scale applications this process was further developed in a mechanised form by using a circular-motion machine to fill and seal the sacs. The cost of a simple capsule fabricating unit is relatively low. The capacity of the machine is around 2,000 to 2,500 capsules per hr. The circular motion system only operates semi-automatically and its operating cost is somewhat greater than that for a fully-automatic unit. The method of sealing is not always considered satisfactory.

Capsule fabrication should be carried out in a cool ambient temperature, because temperatures over 20°C. make fabrication difficult. Basements with adequate daylight are usually satisfactory and avoid the need for air conditioning. To select the right quality of gelatin it is best to consult a gelatin factory. It has been shown in practice that different types of gelatin with almost similar properties cannot be fabricated in the same way. The water added to the gelatin solution should be low in calcium (soft). It is best to use boiled or demineralised water. Beaded, rounded and oval capsules with 0·2-5 ml. capacity as well as those with an elongated neck can be fabricated by dipping.

Dipping method

The capsule fabricating unit requires the following equipment:

1. Gelatin melting kettle.
2. A gelatin container with thermostat and dipping mechanism as well as moulds for the gelatin solution.
3. Filling and sealing (circular-motion) unit.
4. Drying oven.

The melting kettle is equipped with a heating jacket which can be heated by steam, gas or electricity. The following quantities should be used in preparing the gelatin solution:

Gelatin in coarse granules or finely powdered	22 kg.
Glycerine, pure doubly distilled	9 kg.
Sorbitol	4 kg.
Ethyl benzoate or another suitable preservative	17 g.
Water	48 kg.

The water is heated together with the preservative. After this has been dissolved the solution is cooled down to 60°C. and glycerine, sorbitol and gelatin are added. A uniform homogeneous solution is obtained by stirring, and overheating must be avoided.

This solution is then transferred to the dipping vessel which has a diameter of about 40 cm. and a depth of about 80 cm. The water bath and thermostat maintain a uniform temperature, usually between 40° and 45°C. which must be varied according to the ambient temperature. Above the container is mounted a frame driven by a motor which moves up and down. The mould plate to which the moulds are connected (these are usually made from nickel) is fitted to this frame. The size and number of moulds are usually limited by the size of the frame which, together with the plate, is dipped into the gelatin solution. For easier handling this plate is provided with a hand grip.

Empty gelatin capsule sacs are fabricated in the following way: the mould plate is first greased with pure Vaseline, soya bean or olive oil, and is placed on to the frame above the gelatin container. By means of the motor the plate with the mould is dipped into the solution, after which it is raised and the gelatin skin is hardened by air cooling. If necessary the mould is dipped into the container for a second time in order to obtain the necessary capsule thickness. After cooling the skin is removed.

The capsule is filled and sealed on the circular motion machine. This consists of a table on which an aluminium plate revolves horizontally, with a rotating knife, a filling pump, containers, heated gelatin container, injector and gelatin drip-needle. Several sockets are mounted in the plate into which the capsule sacs are placed. The plate then moves from socket to socket. In this way the gelatin sac is cut into equal lengths by the built-in knife. The capsules are filled with an injector and sealed by an electrically heated drip-needle. An air-blast cools the seal. Positioning of the empty capsule sacs and removal of the filled capsules is done by hand. A new model is equipped with an automatic capsule ejector. The metering pump is adjusted by means of a spindle.

All liquids which do not attack the capsule wall, like vegetable and animal oils and fats, essential oils and mineral oils are suitable liquids for filling.[2] Even several polyglycols with a molecular weight over 400 can be encapsuled with suitable addition of water.

Powders can be mixed into the liquid. The size of individual powder particles should be less than 0·1 mm. so that the injector is not blocked up. In order to achieve good dispersion in such a suspension a mixer must be mounted on the filling container. The speed of the mixer should be about 40 to 45 r.p.m. Capsules fabricated in this

manner will always contain small air bubbles. If these are to be avoided the drip or stamping operation must be used.

Drip method (fully automatic)

In this drip operation the machine consists of a heated gelatin container, the filling container, the filling head with injector, sight-glass, pump with cooling attachment and collecting glass. The feed pipe for the gelatin solution with circulating hot water is situated in the filling head. This solution completely covers the filling nozzle. It is best to work with a gelatin solution at 60° to 65°C. The filling material which is expelled at regular intervals within the gelatin forms a capsule which, due to its weight, is torn off and cooled in the receiving oil. After that it falls into a receiver glass. The gelatin solution can be compounded as follows:

Gelatin coarsely grained or finely powdered	6 kg.
Glycerine, pure double-distilled	5 kg.
Sorbitol	2·5 kg.
Preservative, *e.g.* ethyl benzoate	12 g.
Water	36 kg.

In the receiving glass the capsules previously cooled in oil are still soft. After they have been removed from this glass they are immersed in a light oil (*e.g.* purified turpentine oil) and are then placed, together with this oil, into a refrigerator. They remain there at a temperature of +3°C. to −2°C. for about 12 hr. and only then can further treatment be given. The old model of this machine has a capacity of 4,000 to 4,500 capsules/hr. The new model has a capacity four times as great. These figures refer to the 0·1 ml. capacity capsule. For this model no moulds or forms are required. Owing to surface tension only spherical seamless capsules without air entrainment are formed. The variation in weight is ±5% for the dipping operation and ±3% for the drip operation.

Thickness of the capsule wall can be adjusted at the injector. Capsules with a capacity of 0·035 to 0·450 ml. can be obtained on these machines.

Capsules for internal use in human medicine should not exceed 0·350 ml. capacity so that they can be swallowed without difficulty. The liquid mentioned in the dipping operation can also be used in this operation. Powdered additives are possible if the particle size is less than 0·02 mm.

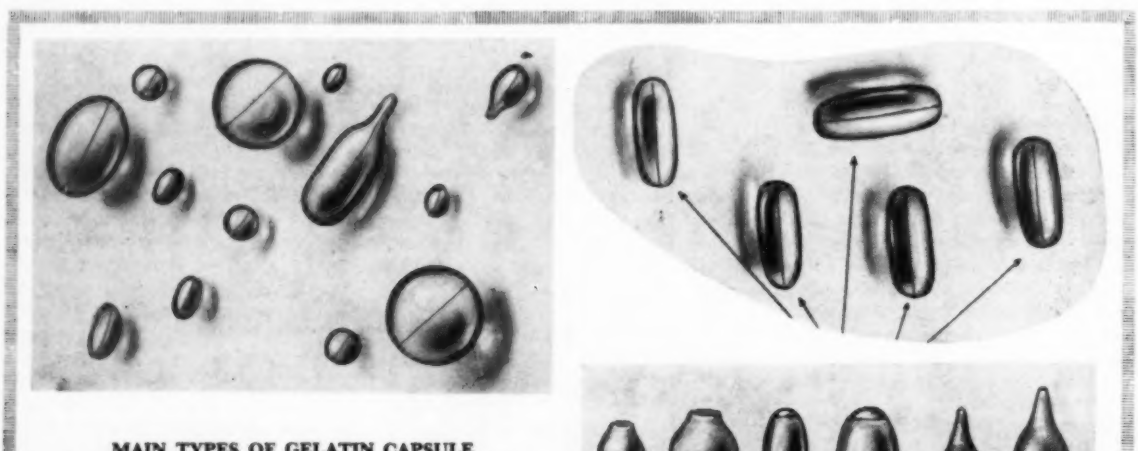
This machine is suitable for producing capsules for all fatty oils (cod-liver oil, etc.) as well as macerated oils (garlic, etc.). Small quantities of water-soluble materials, tinctures and extracts (*e.g.* raw rauwolfia tincture) can be dissolved in a little water and then added to the gelatin solution if they do not react with the gelatin solution. An air conditioning unit is not necessary if the temperature in summer does not exceed 20° to 22° C. The humidity is unimportant under normal circumstances.

Stamping method (semi and fully automatic)

This developed from the plate-pressing operation which is still used in small-scale works. According to the size of the plates a sheet of gelatin, still soft, is placed on two plates. Both plates are placed on top of one another and by means of pressure the forms are stamped out. Because the plates are heated the edges of the gelatin stick together and seal the capsules. The exact quantity of material per capsule varies slightly and very precise workmanship is required to satisfy the specification of the pharmacopœia.

As a result of this operation the chemical engineer R. P. Scherer developed the first continuous gelatin encapsulator in 1933. This made the gelatin capsule competitive with other forms of oral therapy. Machines of this type are of high accuracy and quite costly.

Air conditioning is necessary. The gelatin solution is kept in the containers of the machine at an even temperature by means of thermostats. A cock is fitted to the bottom of the container through which the solution flows into a heated bath. From here it flows on to two continuously cooled, self-rotating drums. The solution gels to form sheets whose thickness can be adjusted to 0·75 to 0·8 mm. by means of slits in the bath. The two sheets of gelatin are led to two rollers situated next to one another; on the surface of the rollers a half mould of the required



MAIN TYPES OF GELATIN CAPSULE

Above: **Round, oval and tubular capsules made by the rotary die process.** *Top right:* **Tubular capsules, also made by rotary die.** *Right:* **Capsules made by dipping.**

R. P. Scherer's integrated capsulation unit showing the filling head and rotary die on the machine, the washing trough in front and the infra-red tumbler dryers on the right. Behind the machine are the drying tunnels.

capsule shape has been milled. The length of the rollers is about 15 cm., diameter about 10 cm., and they are made of a special metallic coating. The sheets are passed between these two rollers which are a very short distance apart. The fitting head with injectors and pumps is placed above the rollers. The projecting lips of the moulds on the rollers stamp out the capsule halves and the heated filling head warms the internal section of these halves. The injector comes into operation and the two halves are immediately stuck together. This procedure is very accurate and takes place after controlled intervals. The filled capsules are automatically ejected after a 90° revolution of the rollers. After filling there are no air bubbles, and the capsules have a barely visible seam at their point of adhesion. The injection cycle of the nozzle is controlled by a special mechanism. Special rollers and pumps are required for each type of capsule. Practically speaking, all types of capsules with the exception of those filled with pure powders can be made with a capacity of 0·06 to 15 ml. According to the type of capsule the machine has an output of 20 to 30,000 capsules per hour of 0·1 to 1·3 ml. capacity. If a larger area on the rollers is required the volume of stamped capsules is proportionately lower. All previously mentioned liquids can be used for filling. Powders must, however, be mixed with liquids. In every case the solution must pass through the pump.

In place of rollers, dies can be used with different types of machines, similar to the punch-dies used in tableting machines. The procedure is similar to that described above.

Integrated capsulation unit

The latest refinement employed by Scherer at their Slough factory is the new integrated capsulation unit. This enables the encapsulation process to be carried on completely automatically to the final drying stage.

Each integrated capsulation unit comprises a capsulation machine similar in basic principle to the earlier types of "Rotary Die" capsulation machines, but to which has been added a number of refinements and automatic transfer equipments which make it possible for the machine to run without an operator continuously in attendance. In the present equipment the gelatin and the filling materials for the capsules are supplied to the machines in bulk tanks of approximately 50 gal. capacity and the material is automatically controlled by pneumatic valves to maintain the correct levels in the spreader boxes from which the gelatin ribbons, forming the outside of the capsule, are cast, and also to maintain the correct level in the small tank feeding the metering pump which injects the fill into the capsules.

After the capsules are formed in the rotary dies, they are first transferred by a shaker chute to a belt conveyor which then transfers them intermittently to the first stage of a solvent washer unit. This first belt conveyor is arranged to keep the capsules separated before they go into the first wash basket. From this basket they are transferred to two further solvent washes and then to two draining stages. From the last drain basket they are transferred by a vibrating chute into the first tumbler dryer stage where they are subjected to air blast and heat from infra-red lamps while being rotated in a wire mesh basket. After a period, which is determined by electrical timing apparatus, the capsules are automatically transferred by means of solenoid operated guide vanes to the second tumbler basket where they are again subjected to air blast and infra-red heat.

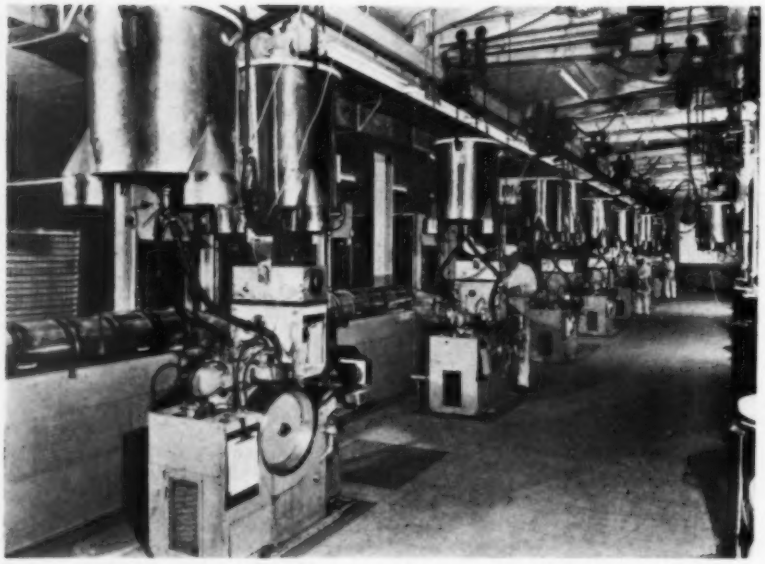
This process is continued until they have passed through five heating stages, by which time a considerable quantity of the moisture in the gelatin shell has been removed. The sixth and last stage of the dryer unit is a cooling one where the capsules are subjected to air blast of room temperature air only.

Powder filling

After the stamping operation another machine can be set up to deal with powders without having to dissolve them in oils. Air conditioning is most important for perfect functioning. Before the sheets reach the rollers they are impregnated on the inside to stop the powder adhering to the gelatin. The gelatin sheets are sucked into the half-moulds and a form of "filling-shoe" transports the powder to the mould, sealing being effected by means of the second gelatin sheet (in other words, the other half mould). The resultant capsule passes into the moving container which is charged with warm air. The capacity of the powder capsule machine is in the same range as that of the previously described stamping machine.

Colouring

If required for internal use, coloured capsules must comply with the food laws. If large quantities of



The new integrated capsulation machines at R.P. Scherer's factory in Slough. To the left of the machines are the infra-red dryers and above them are the feed tanks for the gelatin and filling product.

coloured capsules are required, the gelatin solution itself should be coloured. If only a small quantity is required—for instance, for samples—the same effect can be obtained by dipping the capsules into a water-soluble pigment solution. It is best to colour the capsules immediately after washing as soon as they have been ejected from the machine. After colouring the capsules are rinsed with water, if necessary hardened, and finally dried. As a third possibility it should be possible to colour the contents of the capsules. For this chlorophyll, carotene or oil-soluble pigments can be used. Gelatin capsules can be coloured matt with iron oxide pigments and in this way nice colour gradations can be obtained. Titanium dioxide is recommended for white colours.

In oral therapy an aromatic compound is sometimes added to the capsules. This can however mislead the patient into biting such a pleasant-smelling capsule, something that the manufacturers do not intend. The aroma is added to the gelatin solution. It is also possible to obtain the desired result by dipping the finished capsules into a watery aromatic solution. If the capsules are coloured by dipping, the two operations can be combined.

Hardening

Hardening of the capsules makes them insoluble in the stomach. A hardening bath can be prepared with the following ingredients:

Formaldehyde (4%)	300 g.
Glycerine pure doubly distilled ..	3 kg.
Water	9 kg.

The capsules are placed into a sieve which is immersed in the solution. They can be left in this solution for 1 to 2 min. without making them resistant to the stomach. This is to be recommended for tropical use. Formaldehyde reacts with the gelatin in the hardening bath to form methylene bridges and cross-links.

Drying

Gelatin capsules can be dried[3] on wire lattices or in tin boxes lined with paper. At the beginning this should be done gently. The drying oven is equipped with a ventilator which generates air currents. The initial temperature should be 27°C. This can be regulated by means of an electric spiral together with a contact thermometer. By means of a cooling system the air humidity can be decreased. The dried air is again heated and is circulated through the oven. If the initial air humidity is 50%, significantly lower humidity can be subsequently attained (18 to 20%). With powder capsules an air humidity of 8 to 10% is often recommended. The capsules remain in the drying oven from 24 to 36 hr. Quicker drying can be achieved by means of infra-red installations. The capsules are passed from the machine into a tunnel where they pass on to sieve-like shovels. These are dipped into an organic solvent like methylacetate trichloroethylene or perchloroethylene and after several washings are tipped on to a moving conveyor. They are then dried by infra-red heating. The time for complete drying can be regulated and ejection of the finished capsules takes place automatically.

After the capsules have been filled on the machine they can be sorted by simple hand sieving or with automatic shaking-sieves. The final control is carried out on a table with white lines or a moving conveyor.

Washing and Packing

During fabrication capsules sometimes come into contact with oils used as lubricating materials. Before further treatment (colouring or aromatisation, etc.) they must be washed in an organic solvent. During drying it may happen that uneven capsules require further rinsing. In every working space it is important for health reasons to have proper air ventilation.

Gelatin capsules which are stored unprotected for long periods become moist. Therefore after drying, they should be placed into sealed containers which should be stored in polyethylene or parchment bags.

Uses

By far the largest proportion of capsules are used in human or veterinary medicine.[4] Advantages of this form of administration are air tightness, tastelessness and exact therapeutic effect. Capsules can be used for nose oils, soft cream, concentrated vitamin oils, bath and protective lotions. Food and essential oils can be packed in round capsules as well as tubular ones. Tubular as well as round and oval capsules can also be used for animal fats. Oil pigments for paints and adhesives, petrol for cigarette lighters, stain removers and shoe cream can also be filled into tubular capsules.

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THE SCENT OF FLOWERS AND LEAVES *A Search for Fragrance among the Minor Natural Orders*

By Edward S. Maurer, F.L.S., M.R.I.

2. The Arum Lily Family *(Araceæ)*

Mr. Maurer suggests that the malodorous components of the arum lily fragrance may prove to yield unusual fixatives for perfumes. This is the second article in his series; the first, on the bindweeds, appeared last month.

THERE are about 100 genera and upwards of 1,000 species in this family of herbaceous plants with tuberous rhizomes. Botanically, the single flowers are arranged upon a spadix or central column and protected by a spath or sheath, and bearing large leaves. With such a structure there is a large surface area disseminating odour.

All more or less resemble the British species, cuckoo-pint, lords and ladies (*Arum maculatum*), abounding in the tropics and frequently possessing acrid and poisonous qualities which, oddly enough, are easily dissipated by heat. The most remarkable plant of the order is *Caladium seguinum*; this is the terrible "dumb-cane" of the British W. Indies which has many harmful properties.

Other species which are less noxious in their raw state are *A. divaricatum* and *A. draconitum*, respectively the E. Indian kale and turnip, which are extensively cultivated in tropical countries for their tuberous roots which, when detoxified by cooking, form important articles of native food. Further examples of these food items include many species of the genus *Colocasia*, *C. esculenta*, being known over a wide Asian area as *Kuchoo-root*. Even the British example, *Arum maculatum*, has roots which when properly prepared, are wholesome and nutritious, so much so that in the latter part of the eighteenth century the plant was extensively cultivated in Southern England, and under the name of Portland Sago was used as a substitute for arrow-root.

Potential cosmetic usage

Some of the starches from these plants are very fine grained and have a remarkable suspending power which should at some time attract the attention of cosmetic chemists—incidentally, I find that this order holds much of potential interest for the perfumer.

An interesting speculation

All the botanical texts comment upon the fact that after fertilisation by appropriate insects a considerable quantity of heat is generated at the time of the subsequent expansion of the sheath. I have reason to think that this sudden warmth may promote the biogenesis of some of the malodours—some natural Schiff's bases—for on the one hand we may note the presence of the highly reactive indoles, skatoles, methyl- and propyl-amines and methyl anthranilate, and on the other, cuminic, anisic, salicyl and other aldehydes.

Etymology

The generic name originated from the Hebrew word *jaron*, meaning a spearhead, in allusion to the shape of the leaves, appearing in Latin as *arum*, and *arun* in Greek. Further insight may be gained from the Arabic name for the arums, viz. *nar*, or more correctly as *en-nar* (*ar* = fire), signifying something pungent and fiery, in allusion to the burning and blistering effect of the acrid juices found in all the Arum species indigenous to Western Asia.

The common arums

Arum maculatum: This is the common spotted-leaved arum, generally known as "lords and ladies" or "wake robin," and in some counties as "cuckoo-pint"; there is, however, no connection with the cuckoo-flower or the cuckoo-bird. Before flowering it smells of carrion.

The garden handbooks list upwards of 60 species of arum, but many of the varieties have alternative names and there are also many hybrids.

The scented arums

Of the scented arums, *A. sanctum*, the Black Calla-lily, may perhaps be regarded as the prototype. This is described by one writer as a "... scented variety of this elegant tribe of liliaceous plants and a native of Palestine, where growing wild over a considerable area, it forms a very striking and uncommon feature. In spring, the bulb produces a single large sweet, lily-scented flower rising on a vigorous stalk, giving the plant a stately and elegant appearance."

In so far as the muguet osmophore is concerned, we have primarily the lily-of-the-valley nuance and the more robust oleose cadence of the madonna lilies. But among the arums I find the redolence entrains a somewhat ethereal fungal note, which can be closely approximated by incorporating in hydroxy-citronellal a fairly high percentage of hydratropic aldehyde dimethyl acetal.

We are well aware of the function of light indoloid touches in the simulation of jasmin and neroli compositions, and in a similar manner I think that the osmically correct complementary malodour for emulations of the fragrant arums is to be found among the skunk cabbages—a sad, sour odour which I have found can be formulated on a base of oil of chenopodium, skatole and geranyl acetate.

Miscellaneous araceæ

Arisema: These are closely allied to the arums; there are about 40

species indigenous to Western Asia and several of N. American origin. Of the latter *A. draconitum* is the North American Indian Dragon-root, *A. dracunculus* is the "female-dragon," while *A. papillosum* is one of the many aromatic "snake-roots." All have a characteristic strong but pleasant ferny scent.

Anthurium: The garden manuals list the bewildering number of 230 species of these sweet-smelling "snake-lilies," many of which are incidental to Zanzibar, *A. Duchardi* and *A. odoratum* being the most common varieties. *Pothos* is an allied genus of which there are upwards of 20 species; *P. odoratissima* may be regarded as a typical species, for this is one of the several fragrant B. W. Indian "Silver-vines." Three other items are worth noting; these are the brown-flowered Brazilian *A. rubescens*, the orange Mexican *A. longifolia* and the Peruvian *A. Andreanum*, which are reported as having a sweet, vanilla-like spicy fragrance, but in my opinion it is very likely that there are some very exotic scents to be found among the many remaining species of these "Flamingo" or S. American "Banner" plants.

The genus acorus

The genus derived its name from *kore*, the Greek for eye, for the half a dozen or so species indigenous to Southern Europe and the Near East have long been used as panaceas for the many eye complaints incidental to the Levant. The most interesting species is *Acorus calamus*, the Greek adjective *kalamus* being a generic term for anything resembling a cane or reed, just as in English the verb "to flag" suggests drooping, and as the foliage of this plant resembles that of the iris it has received a similar appellation, hence the common names sweet flag and myrtle sedge. Here the Anglo-Saxon *secg*, meaning a short sword, was applied to the sharp-pointed leaves of such plants growing in fens and ditches as the reeds, rushes and sedges.

This rush-like reed-grass, with its peculiar and long-lasting aromatic scent, has been known since remote times and there are upwards of six Old Testament references to the plant as being a component of incense and sweet-scented oils, while the Hebrew *kenea bosem* signifies the dried aromatic resinous pith extracted from the leaves.

Incidentally, those who may care to refer to Robert Gibbings' "Sweet Thames Run Softly" will find an interesting account of the mediæval "Sweet Herbs for Strewing" the floors of houses, law courts and churches. There are some brief notes on this plant in the O.E. texts, from which it may be gleaned that the oil distilled from the roots has a sweet aromatic pinaceous-camphor note, but the oriental species are more aromatic in their build-up—for example, *A. Indica* is noted as having an asarone content of upwards of 80%, supported by pinene, camphene and methyl eugenol, while the Chinese *A. terrestris* in addition has a fair amount of methyl cinnamate, this complex having an odour suggestive of patchouli.

Sundry tropical scented genera

Colocasia: In the Greek *kolokasia* was apparently a generic name for the edible roots of a number of Egyptian plants; there are about a dozen species closely related to the *Alocasias*, of which there are many species. The fact that *C. odorata* is described as being a typical arum-lily, incidental to Peru and bearing greenish-yellow "flowers" which have a strong mignonette-like odour, suggests that other species may also be scented.

Caladium: Of these cup-shaped flowers there are upwards of 50 wild and cultivated species, of which the S. American *C. bicolor* has roots which are reported to resemble those of the ginger in shape, taste and odour. The E. Indian white-flowered *C. odoratum* and the red blossoms of *C. fragrantissimum* are remarked as having a "Sweet, Calla-lily-like fragrance, slightly perfumed with vanilla."

Calla: This is the renowned "Lily-of-the-Nile," the Greek word *kalos* signifying beautiful in form, colour and scent. There are about half a dozen of these white or blue-flowered Egyptian lilies, Bog Arums or Water Dragons, which are also listed under *Richardia* or *Homalonema*. *C. odorata* has been described as having a scent resembling a mixture of Lily and cloves.

Homalium: In the Greek *homalus* signifies smooth-leaved. *H. fagifolium* (*fague*=beech) is recorded in a Hong Kong Flora as a small deciduous tree, its profusion of lily-scented white flowers are borne in pendant racemes, the leaves somewhat like those of the beech, hence its specific name.

Pistia: This is a botanical term describing the shape of the flowers. There are half a dozen of these W. Indian water lettuce or duck-weeds, which like the rural English pondweeds—Shakespeare's "Green mantle of the standing pool"—may be worth investigating, for in my opinion some of these tropical species could well yield an extract which would emulate the elusive fragrance of wet moss.

Monstera: This is the Greek word for soft pulp. There are some 15 species, natives of tropical America, all of which have arum-like pink or cream-coloured blossoms. *M. deliciosa* may be selected as typical, for it bears succulent fruit having a luscious pineapple scent and flavour.

Philodendron: Rendered literally—to be attached to a tree; referring to the epiphytic habit of the plants of growing upon trees. Of the upwards of 80 species, most are indigenous to Central S. America, of which the red-flowered Demerara *P. fragrantissimum* may be taken as a prototype of the scented species, the odour of which is described as being "lily-like and somewhat spicy."

Ageratum: This Greek name would appear to suggest some kind of everlasting flower. There are about a dozen species of these "Floss flowers" incidental to Mexico, of which *A. conzoides* is perhaps the best-known garden variety. This is reported to have a peculiar strong but not unpleasant odour, which from its common name of false agrimony suggests a cineol-pinene complex.

The malodorous arums

Symplocarpus: This name may be rendered from the Greek as "connected-fruits," for the fruits of this species are compacted into a tight fir-cone-like bunch. The solitary species *S. fœtidus* is incidental to N. America, where it is familiarly known as the skunk, meadow cabbage, or polecat-weed. The first name seems to have been derived from *segonku*, a N. American Indian word which also applied to the detestable animal of the same name. In the first instance the greenish-brown flowers and the bruised foliage emit a stench which suggests a sour valerianic cabbage, while the roots, which incidentally retain their fœtidness for an indefinite period, appear to have in addition a garlic-

(*Continued on page* 71)

PERFUMERY and Essential Oils

By A. J. Krajkeman,* DIPL. ING. CHEM., F.R.I.C.

Flouve oil ● Raspberry aroma ● Laurel berry oil ● Lavender and lavandin oils ● Rose oil ● Ocimum oil ● New perfumery syntheses ● Macrocyclic musks ● Verbenone ● Trimethyloctalone ● Analysis

Flouve oil

THIS useful raw material is obtained from sweet scented vernal, *Anthoxanthum odoratum L.*, which is called "flouve odorante" in French, "paleo" in Italian and "Ruchgras" in German.[1] A commercial oil has the following constants $d_{30}=1{\cdot}1291$; $\alpha_D=+8°\ 45'$; $n_D^{31°}=1{\cdot}5041$; acid value 12·2; ester value 372·3. Little is known about its chemical composition, apart from the fact that it consists mainly of esters and coumarin. A few examples of its use in perfume compounding are given in the paper.

Raspberry aroma

The presence of nerol in the aroma of raspberries has previously been reported. By using column and paper chromatography it has now been proved that it is not nerol but geraniol that occurs in raspberry aroma.[2]

Laurel berry oil

The essential oil from berries of laurel (*Laurus nobilis*) grown in India has been examined and some of its constituents have been identified.[3] The oil was obtained in a yield of 4·1% and had the following characteristics: N^{20}_D 1·4898; d^{20}_{20} 0·9218, α_D −18·9°; acid value 5·92; saponification value 67·94; saponification value after acetylation 99·8; carbonyl compounds 11·48%; alkali soluble portion 9·0% v/v. The following products were identified: α-pinene, β-pinene, cineole, citral, terpineol, methyl cinnamate, and free cinnamic acid. Lauric acid was absent.

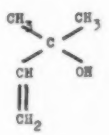
* Söflor Ltd.

Lavender and lavandin oils

The carbonyl compounds of lavandin oil have been analysed by gas chromatography.[4] The presence of ethyl amyl ketone, cinnamic aldehyde, camphor and diacetyl in the oil has been confirmed and the presence of the following products has been established for the first time:

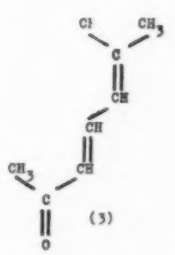
(1)

1. diisopropylketone



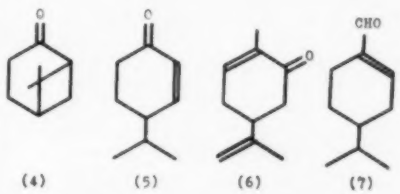
(2)

2. 2-methyl-3-buten-2-ol



(3)

3. 6-methyl-3,5-heptadien-2-one



(4) (5) (6) (7)

4. (-)-nopinone **5. (-)-cryptone**
6. *d,l*-carvone **7. (-)-phellandral**

Naves and co-workers have found that French lavender oil contains approximately 0·02% of (+)-epoxy-dihydrolinalool and 0·05% of (−)-epoxy-dihydro-caryophyllene.[5] They claim to have demonstrated that β-caryophyllene found in oil of lavender "is an artefact."

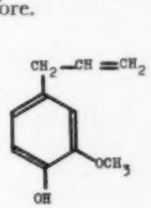
A study of the terpenes fraction of lavender oil by the same laboratory[6] has shown that French lavender oil contains 0·1% of β-myrcene, traces of Δ^3-carene, 0·02% dipentene and 3% of α-ocimene, with a possibility of traces of α-pinene.

Rose oil

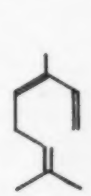
In a study of minor constituents of rose oil[7] special emphasis was put on the free acids and the esters present. By means of paper chromatography acetic and valeric acids were identified both free and as the ethyl esters.

Ocimum oil

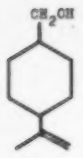
Three different types of oil of *Ocimum gratissimum* are known, namely eugenol, thymol and citral. The eugenol type is produced in Taiwan. The composition of the oil of *Ocimum gratissimum* var. *snavis Hook* has now been studied and the following products have been found[8]: eugenol 62%, ocimene 18%, *l*-cadinene 3% and *l*-perillyl alcohol 4%. This latter alcohol has not been found in ocimum oils before.



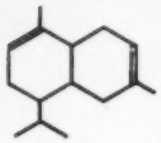
Eugenol



Ocimene



l-perillyl alcohol



l-α-cadinene

Aryl aliphatic aldehydes

Several patents relevant to aromatic chemicals have been granted recently. One of them covers two new perfumery products and claims a novel method for the preparation of aryl aliphatic aldehydes.[9] Unsaturated aldehydes or their diesters are condensed with aromatic hydrocarbons in the presence of titanium tetrachloride with or without the addition of boron trifluoride. For example, toluene is condensed with α-ethylallylidene diacetate and the resulting condensation product is hydrolysed to give the new compound 3-(4′-methylphenyl)-2-ethyl propionic aldehyde in a yield of 91%. This compound is claimed to smell like cyclamen aldehyde.

The other new compound claimed to have a characteristic fruity odour is 3-(4′-iso-propylphenyl)-2-ethyl-propionic aldehyde.

2-Piperonyl-propanal

Another new perfumery compound covered by a recent paper is 2-piperonyl-propanal.[10] This product is claimed to have a very strong and definite odour and to blend well into a variety of perfumes in relatively large amounts. Recipes containing this ingredient are given for perfumes of cyclamen, jasmin and rose types. The simplest method for the preparation of 2-piperonyl-propanal is the condensation of heliotropin with propionic aldehyde with subsequent hydrogenation of the double bond after the carbonyl group has been protected by acetalisation. The hydrogenated acetal is then hydrolysed to give the free aldehyde.

Purifying pseudo ionone

The purification of pseudo ionone by means of its bisulphite compound is unsatisfactory as it gives low yields. A process has been patented[11] which claims that yields can be greatly improved if the bisulphite is used in a proportion not exceeding 1·9 mols but preferably between 1·3 and 1·7 mols at a *p*H of 4·5.

Patchoulione

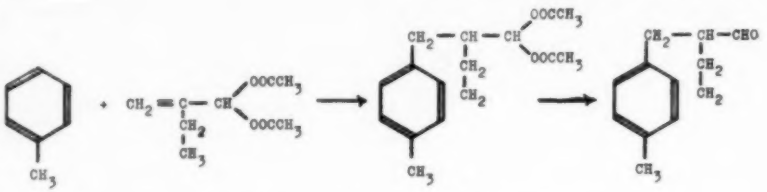
Patchoulione, a chemical possessing a "powerful and striking" ambergris note, has also been covered by a patent.[12] Patchouli alcohol from patchouli oil is esterified with acetic acid and the resulting acetate is converted to a mixture of β- and γ-patchoulene by pyrolysis. Patchoulione is then obtained from this mixture by ozonisation and hydrogenation of the ozonide.

Methyl heptenone

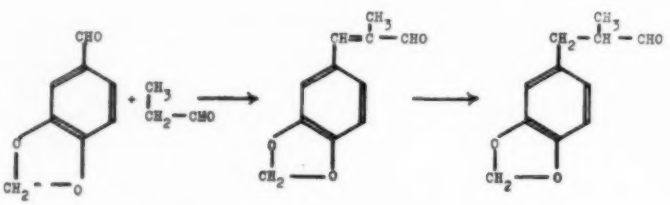
A process for the preparation of methyl heptenone is claimed in a British patent.[13] According to the specification, 1-chloro-3-methyl-butene-2 is condensed with acetone in the presence of alkali. 1-Chloro-3-methyl-butene-2 is prepared from isoprene and hydrochloric acid.

Macrocyclic musks

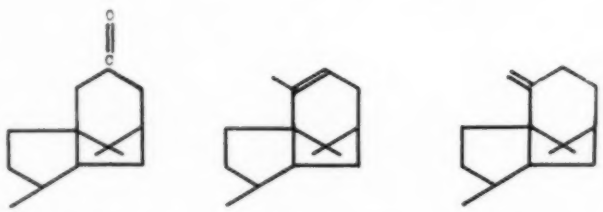
Exaltone and exaltolide have been synthesised from erucic acid[14] and



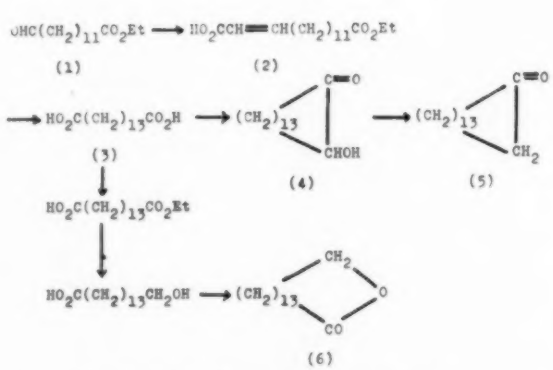
Preparation of 3-(4′-methylphenyl)-2-ethyl propionic aldehyde



Preparation of 2-piperonyl-propanal



Patchoulione **β-Patchoulene** **γ-Patchoulene**



Preparation of exaltolide and exaltone

the process has been covered by an Indian patent (59419; 1957). Erucic acid is converted to 13,14-dihydroxybehenic acid by hydrogen peroxide and acetic acid. The ethyl ester is oxidised by sodium meta periodate to nonaldehyde and ethyl ω-aldehydo-undecane-1-carboxylate (1). This product condensed with malonic acid in pyridine yields the half-ester of tridec-1,2-ene-1,13-dicarboxylic acid (2). Hydrogenation and hydrolysis give tridecane-1,13-dicarboxylic acid (3) which is cyclised to the acyloin (4) by sodium in xylene. Cyclopentadecanone or exaltone (5) is obtained by reduction with zinc. Exaltolide (6) is obtained from the monoethyl-ester of (3) on reduction with lithium borohydride and subsequent cyclisation.

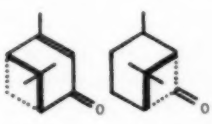
A synthesis of dihydrocivetone from kamlolenic acid by Bhattacharyya and co-workers was described in the last report.[16] The same authors have now published a route to civetone and dihydrocivetone starting with aleuritic acid:[15]

$$HO(CH_2)_6CHOH{\cdot}CHOH{\cdot}(CH_2)_7{\cdot}CO_2H$$

From the same acid they have also prepared dihydroambrettolide and iso-ambrettolide.[17]

Verbenone

Verbenone (1) is converted to chrysanthenone (2) by irradiation with ultra-violet light in cyclohexane solution.[18] In other solvents such as wet ether or alcohol the irradiation products include also the esters (3) and (4) and the acid (5).



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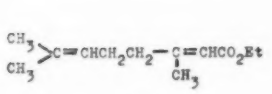

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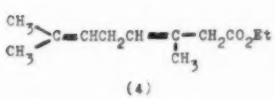

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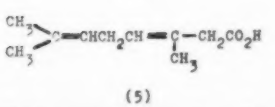
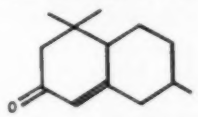


(5)

Irradiation products of verbenone using U/V light

Trimethyloctalone

The product obtained by the condensation of pulegone with ethyl-acetoacetate has now been found to be Δ^4-1,1,7-trimethyl-3-octalone.[19]



Δ^4-1,1,7-trimethyl-3-octalone

Analysis

Evaluation of bergamot oil by conventional analysis may not be sufficient to judge whether an oil is genuine or adulterated. With the great variety of isolates, terpenes and synthetic aromatics available for adulteration, conventional analysis has to be supplemented by modern physical methods, such as gas-liquid chromatography, spectroscopy, etc.[20] Examples are given of two samples which complied with the N.F. specifications, but when examined by ultra-violet and infra-red spectroscopy and gas chromatography both were shown to be adulterated with lemon terpenes, linalool and linalyl acetate.

Gas chromatography has been employed in the analysis of terpenes and oxygenated terpenoid compounds.[21] Didecyl phthalate and Carbowax 4000 were used as stationary phases, and the retention times of 44 terpenes and related compounds were determined. The quantitative aspect of gas chromatographic terpene analysis was studied and the method was applied to the analysis of α-pinene hydration products.

A method has been designed for the determination of residual solvent in oleoresins.[22] A sample of the product under examination is diluted with a mixture of benzene and toluene. The solution is distilled and the distillate is examined by means of gas chromatography. This technique will detect traces of residual solvents such as chlorinated hydrocarbons, hexane, methanol, isopropanol, acetone, etc., which are present in quantities below 50 p.p.m. with an accuracy of ±12 p.p.m.

Myrcene was found to interfere in the ultra-violet determination of citral. A method is described which permits determination of citral in the presence of myrcene by ultra-violet spectroscopy.[23]

Finally, in an article on organoleptic quality and the stereo-chemical theory of olfaction the authors report on some early results they obtained with new methods of testing the human sense of smell.[24]

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SCENT OF FLOWERS

(*Continued from page* 68)

skatole complex. Incidentally, there are at least half a dozen malodorants of a similar genre—for instance, the *Lysichitums* (Camtschatense); the *Amorphophallus*, the Philippine Islands; *Aglaonemas*, and the S. American *Diffenbachias*, the nauseous elements therein would appear to consist of various allyl and butyl disulphides.

Summary

The fragrance of the arum and calla lilies should prove of considerable interest to the perfumer, and an initial acquaintance with the beautiful nuance may follow a visit to the hot-houses in some of the larger municipal parks in which there is usually an interesting exhibit of the scented arums.

I would, however, particularly suggest an investigation of the arum malodorants, which I believe are essential to the build-up of the arum lily nuance. I would further suggest that the tenacity of some of these malodorous materials would lend themselves as fixatives of an unusual genre. The wholesale botanical houses can usually supply the dried roots or galenical preparations of the more common species within this interesting order.

Pest Control Chemicals

By D. P. Hopkins, B.SC., F.R.I.C.

BHC use and production • DDT water solubility • Zinc fungicide Flowability of dust • New weedkillers • New fungicides • Pelleted pesticides

The bed of watercress on the right has been treated with zinc frit whilst that on the left is untreated. Crook root disease has clearly caused much damage to the untreated crop.

BHC and DDT

A FEW recent papers have dealt with these two "giants" of the modern synthetic pesticide age. An English paper gives a full account of the work that has developed an effective liquid seed dressing of gamma-BHC for giving seedlings protection against flea beetle attack.[1] The ability of crude BHC to give this protection to seedlings of brassicas was discovered in 1944, but the development of powder-type seed dressings did not overcome certain defects, *e.g.*, dusty effect on the seed. A suitable liquid seed dressing was found to be an aqueous suspension containing 4% of gamma-BHC, 4% of bentonite and 1% of *Dispersol* T (di-Na salt of methylene dinaphthalene sulphonic acid). Laboratory and field-test work showed that a liquid product with up to 16% of gamma-BHC content was free from phytotoxic risks, but a 4% content was chosen to give a safety margin, particularly as even 2% of gamma-BHC gave good protection in trials. Kale seed treated with 50 ml. of the dressing per lb. of seed, and sown at 4 lb. per acre, introduces only ¼ oz. of the insecticide per acre as compared with 1½ oz. when seed treated with a powder dressing of gamma-BHC is sown. Both these levels are below danger point for tainting potatoes grown as a succeeding crop on the same land, but the safety margin is clearly much wider for the liquid dressing, which is also more economical. The paper reports data for protection given against flea-beetle attack on kale and turnip seedlings. Further research is needed to establish a suitable formulation for incorporating a fungicide in the liquid seed dressing.

Production of BHC

The American Stauffer production process for gamma-BHC has been described.[2] Benzene is chlorinated at a low temperature in a solvent system involving acetic anhydride and carbon tetrachloride as the main constituents. Chlorine concentration is constantly monitored by an automatic analyser. Residual chlorine is removed in a secondary reactor and two stripping steps remove residual solvents. The product emerges in a molten state, is pelletised and air-dried, before transport to a grinding plant at another works. The product contains 26% of the gamma isomer and is almost wholly free from benzene tetra- and hepta-chlorides, which cause much of the odour trouble with BHC preparations. The pelleted form made easily possible by the process facilitates grinding and handling.

Water solubility of DDT

A new U.S. paper[3] has described radio-isotope investigations of DDT's water solubility, which is very low, and also has been variably reported in the literature. In addition to using carbon-14 DDT, an ultra-centrifuge was necessary to remove undissolved DDT particles from saturated aqueous suspensions. The solubility of DDT in water at 25°C. was found to be 1·2 parts per billion or less. Previous assessments have been 1,000 p.p.b., 100 p.p.b., and 37·4 p.p.b., with only one measurement as low as the new evaluation, 0·2 to 1·0 p.p.b. at 15°C. in 1946. For so slight a solubility these differences may seem unimportant, but a more precise knowledge of DDT's solubility is needed for bio-assay studies with mosquito larvæ.

Zinc as a practical fungicide

Zinc's fungicidal properties have long been known but other fungicidal metals are more commonly used. A specific use for zinc has been accidentally discovered.[4] A previously unrecognised disease of watercress was first observed in 1947—crook-root disease. This has become widespread in commercial beds in Southern England, and it has now also appeared in Belgium and France.

The causative fungus resembles the clubroot fungus in that it produces zoospores that penetrate the outer cells of the plant roots, causing swelling and distortions. Each infected root produces more zoospores in a rapid cycle so that infection of a watercress bed occurs vigorously. The main effect on the

crop is to stunt plants seriously, particularly in cold winters.

In laboratory work testing various fungicides there was a series of failures to transmit the disease despite inoculation, and this was found to be due to using water containing minute traces of zinc—only 1·8 p.p.m. The zinc came from a galvanised iron pipe feeding the taps at the laboratory concerned. Later experiments showed that only 1 p.p.m. of zinc added as zinc sulphate could quickly kill zoospores of crook-root disease.

Practical development, however, had to face the problem of maintaining a zinc concentration in watercress beds which are fed with springwater often flowing at 300,000 to 500,000 gal. per day. An almost insoluble zinc-containing material was needed so that, placed on the floors of the beds, it would release zinc very slowly. The problem proved intractable until U.S. work on "glass frits" for trace element supply was reported (frequently referred to in MANUFACTURING CHEMIST Progress Reports on fertilisers and plant nutrients). A zinc frit was obtained and initial trials on commercial beds showed spectacular cure at a rate of 1 lb. per sq. yard.

Later usage showed, however, that annual application of the zinc frit—necessary as a single application lasted for one season only—led to iron deficiency in the watercress. Attempts to cure the iron deficiency led to excessive uptake of zinc. Further trials with stronger zinc frits (36% content of ZnO compared with the 23% content in the material first used) and with more finely ground material have shown that smaller rates of use can be effective, and it is more likely now that the frit method may be successfully developed. Meanwhile, on beds where the incoming water emerges from one or only a few springs, the disease is being cured or checked by treating the water with zinc sulphate at inlet points; but this method requires very precise equipment and operation to avoid toxic concentrations of zinc.

Dust flowability

An apparatus for obtaining a flowability index for pesticide dusts or for dust-carriers before mixing is a simple feed funnel with a 60-mesh screen and a receiver. It is clamped to a variable frequency vibrator that enables the screen to be vibrated in a reproducible manner. A 5-gram sample of the test material is put into the funnel and the time taken for all the sample to pass through the vibrating screen is measured. The flowability index is assessed against the time taken for 5 grams of a standard good-flowing dust to pass through the screen under similar conditions; in the U.S. report an attapulgite dust was taken as the standard. The index suggested is:

$$\frac{\text{time}_s \times \text{density}_s}{\text{time}_b \times \text{density}_b} \times 100$$

where time_s and time_b are the times of flow for sample and standard dust respectively, and where the density figures are light pack densities determined in a paint pigment volumeter. It is suggested that this easy laboratory test can replace various methods commonly used for assessing flowability, *e.g.* rubbing between the fingers.

New weedkillers

Developments in weed control during 1958-60 have been reviewed on a basis of chemical classification.[6] This groups products into three classes; a nitrogenous class—amide, urea, amidine and carbamate types; a class of substituted phenoxy and benzoic acids; and chlorine and methyl substituted acetic acids. Most new weedkillers fall into the first class. Four new acetamides with post-emergent contact effectiveness are selective and are being widely tested: solan, N-(chloro-4-methyl - phenyl) - 2 - methyl - pentanamide; karsil, N-(3,4-dichlorophenyl) - 2 - methylpentana - mide; dicryl, N-(3,4-dichlorophenyl) - 2 - methyacrylamide and FW-734, N - (3,4 - dichlorophenyl) - 2-propionamide.

The first three are all selective to crops such as celery, carrots, parsnips, parsley, but each differs slightly in range. A new carbamate of considerable promise for controlling wild oat in cereals, one of the major unconquered fields, is barbane, 4-chloro - 2 - butynyl N - (3 - chloro - phenyl) carbamate. This is ineffective applied to soil but active as a foliar spray. It is toxic only to a limited range of weeds, but the range includes wild oat at the 1½ to 2 leaf stage. Also proved useful against wild oat in cereals in Canada is avadex, 2-3-dichloro allyldiisopropyl thiolcarbamate; this is applied to the soil and resistant crops can be sown immediately or within three weeks. Wheat seems less resistant than barley.

Triazines

The triazines are described as the most interesting new group of 1958-60, but these, typified by simazine, have been mentioned formerly in these reports. It is more novel to mention new nitrile herbicides, for though nitriles are known to be phytotoxic, none until recently had been considered active enough for herbicidal use. 2,6-Dichlorobenzonitrile is promising as a pre-planting soil-incorporated weedkiller. It is only minutely soluble and kills germinating seeds with its vapour. It is highly toxic to many weed species. Diphenyl-acetonitrile is not as active though somewhat similar in action.

Structure and activity

A paper on structure-activity relationships among diphenylacetonitriles is referred to.[7] Screening tests for phytotoxicity using a wide range of plants showed that activity was retained by mono-substituted derivatives only if the halogen was in the 3- or 4-position on one of the phenyl groups; with dichloro-substitution, only the 3,4 positions were associated with appreciable activity. Most structural changes to the basic parent molecule greatly reduced or eliminated activity, *e.g.* replacing one phenyl with a phenoxy group.

Benzoic acid products

As to new benzoic acid class herbicides, amiben—3-amino-2,5-dichlorobenzoic acid—seems more useful than the related dinoben, with similar structure except that the amino-group has been oxidised to a nitro-group. TBA has been given greater selectivity by putting a methoxy- or methyl-group in the place of the chlorine in the 2-position and by bringing in an extra chlorine atom in the 5-position, *e.g.*, 2 - methoxy - 3,5,6 - trichlorobenzoic acid; this may combine powerfully selective weedkilling activity with relative safety to cereals.

Action through soil

Many of these new weedkillers act by entering the soil and being absorbed by plant roots; this is, of course, in contrast to most of the established selectives with their entry through foliage. A lack of fundamental knowledge about the uptake of large molecules by plant roots may handicap the practical development of these soil herbicides.

Usage

As to the practical use of modern weedkillers, a sample survey of some 300 Iowa farmers[8] has shown that 87% of them used weedkillers compared with only 30% who used soil insecticides and only 19% who used crop insecticides. This simple statement slightly exaggerates the difference in usage; for weedkillers, though used by more farmers, were used on a smaller proportion of farm acreage than crop insecticides; however, even allowing for this, it is the weedkiller among modern pest control chemicals that has made by far the biggest entry into *farm* practice. The Iowa survey results confirm what is generally believed by agriculturists.

Dalapon

A British paper[9] has surveyed the use of weedkillers on grassland, with some emphasis upon the performance of dalapon, particularly for eradicating weedy swards from poor permanent pasture so that re-seeding can be successful without ploughing. This technique must still be classed as experimental.

Pyrethrolone

In the last Report (see MANUFACTURING CHEMIST, October 1960, 448) Rothamsted progress in isolating the pyrethrins and cinerins I and II was mentioned. The full account of this work has now been published.[10]

New fungicides

A range of possible new fungicidal compounds for use in mildew prevention has been indicated[11] by U.S. research. These are amino-alcohols synthesised from citrus(+)-limonene. They were prepared for other purposes and it seems that their odour, resembling that of other sanitation-type fungicides, prompted tests for activity against mildews and fruit rots on harvested oranges. The parent substance is 2-amino-1-*p*-menthanol, and three out of five derivatives showed activity justifying further investigation. This work is very preliminary so that early comment may be premature, but it would seem that control given by these new compounds is not greater than that given by citrus fruit fungicides already being commercially used.

Pelleted pesticides

The use of pelleted weedkillers and insecticides has been referred to in previous Reports; this mainly American development is to be introduced into the U.K.[12] Elimination of drift hazards and simpler application, using fertiliser machinery, are claimed as advantages.

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EVANS' VACCINE UNIT

(*Continued from page* 56)

services building on the ground floor. Other equipment includes a water demineraliser, sterile filters, vial washing machine, vial filling machine and autoclaves. On the upper floor are laboratories and offices.

The staff is mainly female and most are new recruits. Since distemper virus does not infect humans, it happens to be a suitable product for training new staff. It is the first time Evans Medical have made distemper vaccine and they are conscious that they are entering a highly competitive market.

The principal plant contractors were:

Stainless steel benches, etc.:
Stainless Steel Plant Ltd.
Sterilizers:
Manlove Alliott Ltd.
Glassware washing machine:
Dawson Bros.
Water purification plant:
Patterson Engineering Co.
Refrigerators:
L. Sterne and Co. Ltd.
Centrifuges:
Martin Christ Ltd. and Sharples Centrifuges Ltd.
Ovens, incubators and water bath:
Laboratory Thermal Equipment.
Stills:
Manesty Machines Ltd.
Calorifier:
Lumby Ltd.
Pumps:
Rhodes, Brydon and Youatt Ltd.

IMMUNOLOGICALS

(*Continued from page* 62)

the possibilities of effective prophylactic vaccination. It was Prigge who introduced with his "vertical resistance analysis" a novel multi-dimensional approach to the determination of bacterial resistance into the chemotherapy of tuberculosis.

Polio vaccine

The scope of scientific activities in the three institutes has been extended by the need for intensive work on poliomyelitis vaccines. The virology department of the Ferdinand Blum Institute attached high importance to the significance of negative results in testing. It was an attempt to improve the safety measures for the control of this inactivated product. The solution of the question asked by the Paul Ehrlich Institute: "How great is the probability that a vaccine tested with negative result contains z or more virus particles per unit of volume?" (in contradistinction to the question "How great is the probability that a vaccine containing z or more virus particles per unit of volume gives a negative result?") has clarified the significance of negative results in testing. According to the tradition of the Paul Ehrlich Institute the virology department is working on a problem of high interest: that of measuring the potency of poliomyelitis vaccines. At present we can only give qualitative declarations, *i.e.* to say whether a vaccine is effective or not. The Paul Ehrlich Institute and the Ferdinand Blum Institute have begun to develop methods which make possible quantitative declarations, *i.e.* to determine the potency and to produce a standard preparation for poliomyelitis vaccine.

The three institutes carry out a great number of other activities in general immunobiology and microbiology, which include the establishment of a Salmonella and Shigella centre, research on syphilis, brucellosis, erysipelas and anærobia. Intensive work is done also on the development of methods for testing live polio vaccine, on rabies and Newcastle disease, in the field of immunopharmacology, and on the toxicology of bacterial toxins.

Management and co-ordination of all activities by one director and close ties between the staffs firmly link the three institutes and enables scientists to collaborate fruitfully.

Heterometry

M. Bobtelsky. D. Van Nostrand Co. Ltd. London. 1960. *Pp.* 229. 42*s.*

HETEROMETRY is the name given to the subject developed extensively by Professor Bobtelsky at Jerusalem University. It deals with the photometric study of chemical reactions in suspensions on a quantitative basis, being concerned with reactions both in solution and in the solid state. Heterometric titration curves or optical density curves are obtained from a plot of light absorption against volume of titrant and the location of critical or change points determined. It is primarily, therefore, a method of determining end-points.

A "heterometer," designed by the author, is used to obtain the heterometric curves, the titrations being done with the light passing vertically through a cylindrical absorption cell; in order to make the measured optical values more reproducible, a thermostat jacket is used round the reacting vessel through which water at 20°C. is passed.

The book describes much of the work of Professor Bobtelsky and his colleagues and deals with many aspects of the subject. In addition to studying reactions in which there is a heterometric phase, the author states that heterometry may also be used for the rapid analytical determination of traces (of the order of 0·1%) of metallic ions or compounds in the presence of a large excess of additional substances.

The early chapters of the book deal with the development of heterometry, its relation to other physico-chemical methods, and techniques and instrumentation. This is followed by descriptions of the determination of a large number of metals using heterometric methods, taken mainly from papers published by Bobtelsky and his co-workers. The final chapters extend the work to the study of complexes, the study of chemical reactions by heterometry, and heterogeneous chain reactions.

After reading the book the reviewer was left in some doubt as to the advantages of heterometry over existing techniques. Nevertheless, the book is well produced and nicely bound and is interesting as a detailed account of a potentially useful new method.

R. E. STUCKEY.

The Chemical Senses in Health and Disease

By H. Kalmus and S. J. Hubbard. Blackwell, Oxford. 1960. *Pp.* 95+v.

THIS attractive little book is a follow-up of an excellent article Dr. Kalmus published in the *Scientific American* in April 1958, and which having been written in simple language had considerable popular appeal. The language employed in the book is much more technical, and it is presumably written for scientists. Probably even they will be given pause at p. 14 where they are asked to consider the concept of "vibrational degeneracy" of molecules; later on, too, some of the nomenclature relating to the physiology of the chemical senses is very professional.

But what the authors have to say is usually good; their statement (pp. 14, 15) of the objection to the use of properties of molecular vibrations in theories of chemical sensation is clear and succinct. The discussion (p. 33) of the relative merits of the "four basic taste receptors" and the "continuous spectrum" theories is balanced and informative. Particularly good is the description (pp. 37-46) of the variation in humans of taste reactions to phenyl thiourea; this substance is very bitter to about two-thirds of European adults and tasteless to the other third. To nearly all Africans and American Indians it tastes bitter. "Frequencies of tasters in mixed populations have been used for estimating the proportions in which the assumed parental stocks may have contributed to the mixed people." Reactions to phenyl thiourea is a subject on which Dr. Kalmus has published several original papers, and his treatment of the subject in the book under review is authoritative and enlightening.

The effect of disease on the chemical senses is dealt with in chapter 6 entitled "Chemical Sensation and Disease" (pp. 76-81). It is evident that a book of about 30,000 words can deal adequately with only a few facets of the chemical senses in health and disease. Those parts that are dealt with at reasonable length are well done, but one cannot but regret that such able authors should have been content to write so sparingly of other aspects of their chosen subject.

R. W. MONCRIEFF.

Chemicals, Drugs and Health

By Dr. J. H. Foulger. Charles C Thomas, U.S.A., and Blackwell Scientific Publications Ltd., Oxford. 102 *pp.* 34*s. net.*

WITH the synthesis of more and more "natural" and "unnatural" chemicals, many people wonder what effect these synthetic products will have on the general health of the population. This book sets out to answer the question "Will 'unnatural' chemicals, which are potentially harmful to the body in large doses, inevitably be harmful when encountered in very small quantities in the atmosphere of the home or the work place?"

To answer the problem the author describes briefly the differences between "natural" and "synthetic" chemicals, and how chemicals may enter the living tissues. The chemical functioning of the cell is then described, including the action of enzymes and how they can be poisoned. Generally speaking the impression obtained is that the body has an amazing resistance to invading chemicals in very small doses. The final chapters of the book deal with some of the symptoms of absorption of small quantities of these chemicals, these symptoms disappearing without residual injury when the body is removed to an uncontaminated environment.

After reviewing the carcinogenic effects of new chemicals, the author concludes that not only are foreign chemicals not harmful in very small quantities, but in some cases may even be beneficial.

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PACKAGING—1961 STYLE

New Ideas for the Manufacturing Chemist

Never before has there been such a wide choice of packs, containers, materials and machines for the manufacturing chemist and manufacturing perfumer. On the following pages we present a selection of innovations designed to improve still further the efficiency, functional qualities and eye appeal of packaging in 1961.

NEW WAYS WITH ADHESIVE TAPES

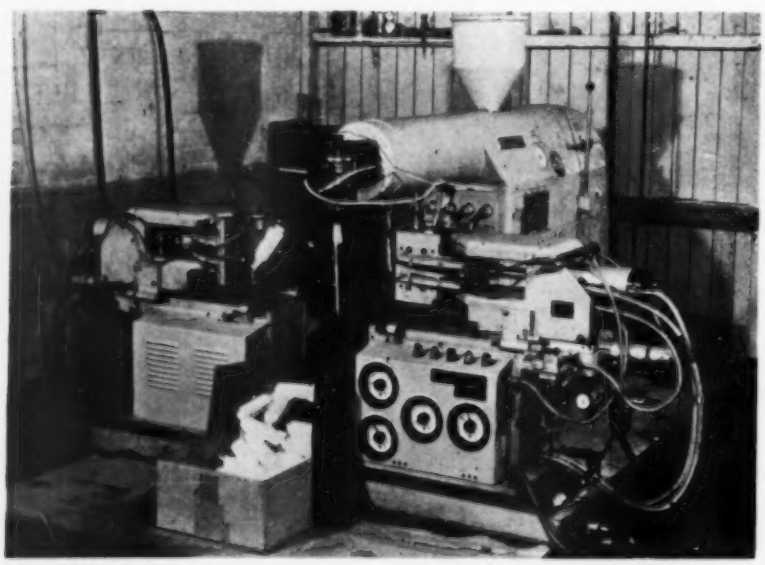
Developments at John Gosheron and Co. Ltd. over the past year have included advances in packaging and printed self-adhesive and new methods of application.

A new high tension adhesive has been applied to the pastel colours of *Transotape* cellulose tape to impart the same degree of tenacity as with transparent *Transotape*. This means that the tape is less prone to coning, it has better handling properties, it is easier to dispense and is suitable for automatic taping machines.

Improvements have also resulted in the *Transoprint* range of printed tapes which rely to a certain extent on pastel colours to provide a suitable background for the printed message or design. *Transoprint* on a pastel coloured tape background can now replace any clear cellulose tape with no fear of a weaker adhesive. The chances of offsetting are eliminated.

The *Spartan* shallow " U " sealer is also of interest. Each carton is simply pushed across the mechanism and cellulose tape is applied in an instant " U " seal along the butt flaps. A cutting arm trip severs the tape which is wiped down by the applying roller at the end of the operation. Any length of pack can be sealed as the rear lower corner of the pack controls the final sealing operation.

The *Superbond* adhesive will withstand higher temperature than normal adhesives and performs very satisfactorily when the labelled article is subjected to oil or water. *Superbond Tickotabs* are available at the moment in paper and glassine, plain or printed, at no extra cost, and will dispense from their backing paper faster than ordinary *Tickotab* self-adhesive labels.



Plastic bottle manufacture. *This machine, at the works of Lax and Shaw Ltd., produces plastic bottles by extrusion. Various types of bottles are made by them, both rigid and flexible. They can be supplied embossed or decorated, the latter by either offset or screen printing methods. The sizes range from ½ oz. to 20 oz.*

FASTER SEALING OF FOIL-LAMINATED CARTONS

A new technique for sealing aluminium foil-laminated cartons and boxes with a heat-setting adhesive has been evolved by a firm of adhesives manufacturers. It is said to give fast and efficient sealing and is suitable for all operations in which the time and space for applying heat can be provided. The adhesive is applied cold and is then set to a thermoplastic gel by heat before the surfaces of the closure are pressed together.

Several of the leading carton manufacturers are experimenting with the new heat-setting adhesive. At present the most favoured method of sealing foilboard containers is to use an emulsion adhesive powerful enough to key to the brilliant metallic surface of the laminate. These adhesives never completely harden, but give a satisfactory closure provided care is taken to avoid " skewing " in the pressure chamber—a fault which could lead to trouble on filling machines. Dextrine and animal glues are not suitable; they can cause bad staining and even damage the container.

Left: *4 oz. aerosol container made by the Metal Box Co. for plastic dressings has an extruded aluminium body with tinplate mounting cup and domed bottom. The dustcover is made of white polythene. Two colours are used—dark and light blue—on a white coating. The printing is done in the round using an offset litho process.* **Centre:** *Multiple packs being sealed with cellulose Transotape made by John Gosheron and Co. Ltd.* **Right:** *Extruded aluminium containers made by the Metal Box Co. Ltd. are used by I.C.I. for Trilene. They have a pourer neck pressure-welded into position which has a thin, easily pierced aluminium diaphragm at its lower end. Re-closure is by a cork stopper. The pack provides a hermetic seal specially suited to ether and other volatile substances.*

Information on the properties of aluminium foil laminates and their uses for both decorative and functional packaging can be obtained from Venesta Foils Ltd. and Fisher's Foils Ltd.

STRIP PACKAGING AWKWARD PRODUCTS

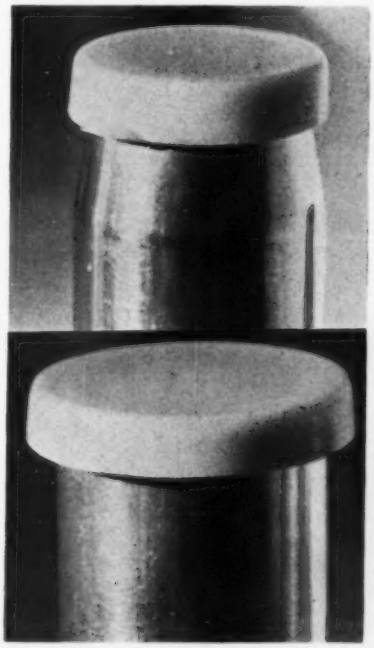
Gordon and Gotch Ltd., U.K. agents for Wolkogon strip-packaging machines, have added the *Model M/3* to the range. The new machine is capable of packing many products, on which, due to their size and shape, it was impossible to strip-pack. It will be of value in the pharmaceutical industry for packaging tablets, dragees and capsules.

It can handle round products ¼ in. × 2¾ in. diameter, and rectangular products 2¾ in. × 2 in. wide up to a maximum thickness of ⅝ in., at an output rate of 50/60 per min. Other shapes and thicknesses can be packed by the *M/3* subject to examination.

Incorporating adjustable devices for cutting, both vertically and horizontally, the machine can use all heat-sealable materials. It automatically counts, perforates, centres printed material over contents, and impresses "easy to tear" notches adjacent to each item if required. It is supplied ready for use with ⅓ h.p. motor and electrical fittings.

PLEXICAP CONTAINERS

Plexicaps are a new range of extruded aluminium containers developed by the Metal Box Co., equipped with specially designed plastic caps.



Plexicap containers. *A comparison between the full aperture pack and the necked-in pack. The latter offers economy of space in cartoning or bulk packing because the diameter of the cap, when it is in position, is the same as the diameter of the container.*

The aluminium tubes have an outward curl at the top which is tightly gripped by two sealing rings on the inside of the cap. One ring is on the skirt of the cap and fits closely round the outside of the curl, while the other is on the top of the cap and presses against the inside of the tube. The seal obtained in this way is comparable in performance to that of a screw cap container fitted with a rubber wad, but costs less.

There are two styles of Plexicap container. One is the "full aperture" type in which the open end is equal in diameter to the rest of the tube. In the smaller diameters this is ideal for pillar packing.

The other style has the top "necked in." In this case the outside diameter of the cap, when it is put on, is the same as the diameter of the tube, giving a neater appearance and having economic advantages where individual cartoning and bulk packing are concerned.

The complete range of containers will consist of 11 diameters with full aperture, from 20 mm. to 75 mm., and five diameters with the necked-in aperture, from 25 mm. to 70 mm.

At present eight diameters are available between 20 mm. and 45

mm. for the full aperture containers, and four between 25 mm. and 50 mm. for the necked-in style.

For full aperture tubes, heights from 1½ times up to 6-7 times the diameter can be obtained. Necked-in containers, where variations in height involve costly tooling, will be available in a limited number of standard heights.

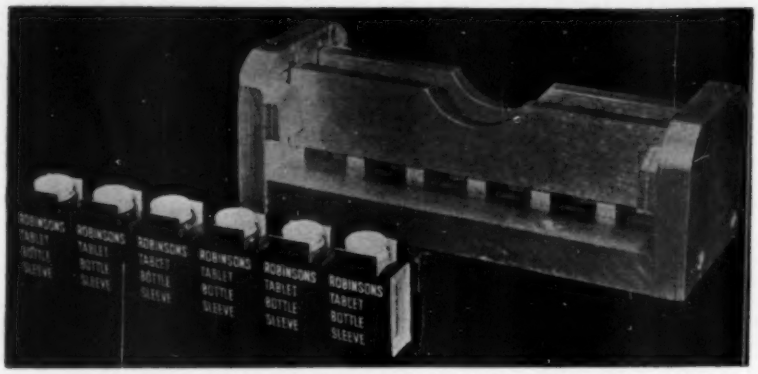
The tubes can be decorated in up to four colours on any light coloured background coating. The caps may be supplied in any of a range of several colours and can be die-printed, or special part moulds can be made to include an embossed name or trade mark.

The closure is designed for simple capping by a downward pressure on the extrusion. Metal Box can supply suitable automatic equipment. For small runs, the closure can be applied by semi-automatic means.

LINKING CARTONER AND OVERWRAPPER

The Forgrove Machinery Co. Ltd. are now producing *CMV* machines designed by Jones of Cincinnati. A *CMV's* function is to feed cartons from a vertical magazine, erect them and close by tucking both top and bottom flaps. The action of inserting the load into the carton is manual.

The machine operates on a continuous motion cycle. This gives production flexibility and, in fact, the machine is primarily designed as an easily interchangeable medium speed cartoning machine. Change of size is effected by adjustment only, rather than exchange of parts, and each machine is calibrated whilst on test so that operating staff can change over from one size to another in approximately 30 min., following charts that give the calibration numbers. This time refers to a practised operator making a three-dimensional change.



Bottle and tube pack *designed to protect products packed in multiple form. Behind is a hand operated loading and sealing machine for quickly assembling these new packs.*

The speed range of the machine is approximately 40 to 120 cartons/min. but it can be extended to give special low-speed minimums.

Use has been made of the cartoner to link up with the Forgrove *LFA* carton overwrapper. Cartons pass from the *CMV* cartoner to a special synchroniser which loads the *LFA* overwrapper. Overwrapping can be made in cellulose or polythene film, kraft or waxed paper, foil and many other materials.

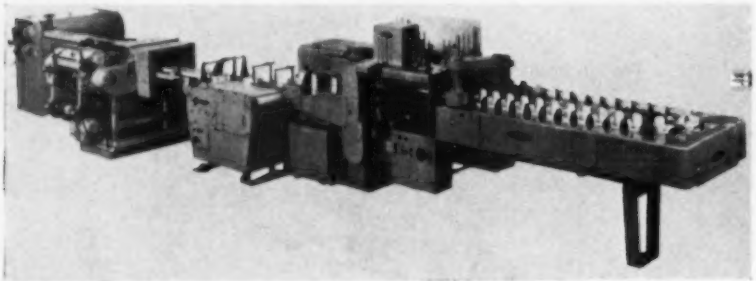
A case-packing machine can also be coupled on, fed automatically from the discharge of the *LFA* overwrapper. In certain suitable instances, *LFA* machines or other machines from the Forgrove range can be supplied to bundle automatically—to wrap an assembly of individual items direct from the cartoner.

AUTOMATIC SCREEN PRINTER

The development of simple automatic screen printing machines has led to a much wider use of the screen process for marking containers. The compact *Rondec 510* can print clearly onto the whole range of containers used in modern packaging. The resulting prints are claimed to be more durable than those of any other method and are good for many years' shelf life. Machines are available for printing cones and cylinders ranging from ½ in. diameter to 22 in. diameter.

Initial outlay and operating costs are low. Output is up to 1,000/hr. The manufacturers, Gayler and Hall Ltd., offer a comprehensive screen supply service.

Automatic screen printing *is possible with the Rondec Model 510 on tins, bottles, glass and polythene. The machine is manufactured by Gayler and Hall Ltd.*



Linked cartoner and overwrapper *produced by the Forgrove Machinery Co. Ltd. Cartons can be seen passing from the CMV cartoner to a special synchroniser which loads the LFA overwrapper. A case packing machine is also coupled on at the extreme left. The speed range of the machine is approximately 40 to 120 cartons per min.*

MULTIPLE BOTTLE AND TUBE PACKS

These packs have been designed to protect bottles or tubes packed in multiple form, and to provide an easy method of dispensing single units to purchasers without destroying the display and advertising value of the remainder of the pack.

The complete units are easy to handle, and they have a pleasing shelf and counter appearance together with the advantage of allowing adequate space for printed matter across the full width of the pack. The packs can be adjusted to take

bottles and tubes of different sizes and shapes.

Simple hand-operated loading and sealing machines can be supplied which provide a quick and easy method of assembling, filling and sealing these new packs.

The manufacturers are Robinson and Sons Ltd.

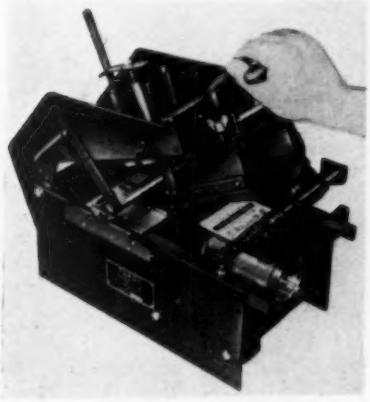
HAND LABELLING MACHINE

Short, interrupted and sampling runs, and even experimental work before labelling reaches the automatic stage are often necessary. Accordingly, Purdy Machinery Co. Ltd. have designed a hand labeller for flat, square, oval and polygonal shapes as well as round, with a minimum of trouble where change-over is concerned.

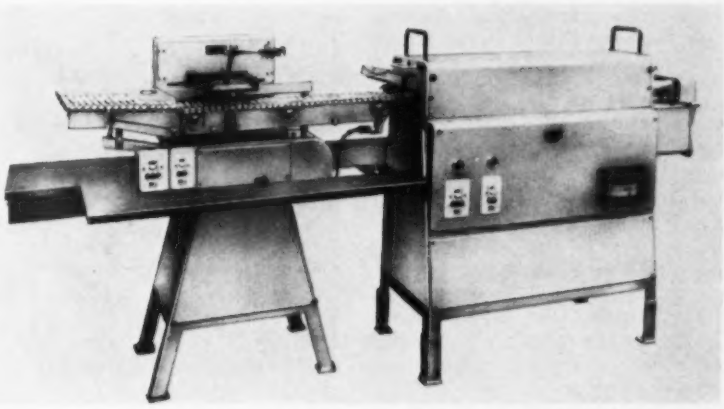
Their *Prestofix* machine with one pull of the handle actuates, through an ingeniously designed linkage, the full labelling cycle of gumming a static picker plate, picking a label from the label magazine, transferring the label to the bottle or container and wiping it securely in position. It is completely portable.

Cleaning is simple, all parts being readily accessible and the gum box, situated beneath the picker plate, can be quickly removed for servicing. All labelling parts have been designed for speedy adjustment and quick change-over.

The machine will label bottles or containers from 2½ in. diameter up to 3¼ in. diameter, label sizes being from 1½ in. up to 3½ in. deep by from 2 in. up to 4½ in. wide. The maximum label width formula for round bottles is, half of circumference less ⅛ in., and the maximum label height is 6 in. from the bottom of the bottle to the top of the label. Maximum container width, in the case of shapes other than round, is 5½ in.



Prestofix hand labelling *machine made by Purdy Machinery Co. Ltd. It will label round, flat, square, oval and polygonal shaped bottles or containers.*



Silk screen printing *machine marketed by Newman Labelling Machines Ltd. Vials and ampoules are automatically screen printed and annealed. Output is between 37 and 47 ampoules per min. depending on size.*

RAPID APPLICATION OF CELLULOSE SEALS

The John Burton Cellubander machine is designed for the rapid application of Viskrings to bottles and other types of containers.

Reels of continuous cellulose seals are kept in supply bins below the machine. The cellulose tube issues from the reel over a spool on top of the machine and a patented floating mandrel is inserted in the end of the tube to establish the seal diameter. A circular knife cuts the seal to the correct length as the container passes under the mandrel.

The mandrel is actuated by the presence of the bottle and whenever it contacts the top of a bottle which has been automatically centred underneath, a predetermined length of cellulose tube is pushed down to produce the individual seal over the neck and cap.

The machine can be reloaded without interrupting operation. Each mandrel operates independently of the other and for a new bottle height the whole mandrel assembly is raised.

Each machine is custom-built for sizes from gallons down to small vials. The four basic models produced operate at 25 to 225 containers/min.

Viscose tubing is manufactured by the Viscose Development Co. Ltd. and the agents in this country for the new machine are F. and C. Engineering Works Ltd.

Label protection *on bottles of chemicals using Transoflex clear polythene tape made by John Gosheron and Co. Ltd.*

PRINTING ON GLASS AMPOULES AND VIALS

Newman Labelling Machines Ltd. have accepted the sole U.K. agency for the Ardenghi silk screen printing machine.

This machine is a fully automatic screen printing and firing machine for vials and ampoules. It is claimed that it provides an output (37-47 ampoules/min. depending on size) by fully automatic means, in excess of any similar machine. The machine anneals a very large number of ampoules within a small furnace area, whilst still providing the pre-heating necessary to achieve the best results from ceramic inks and colours.

The method of operation is as follows. Ampoules are loaded into a hopper, the bottom of which has a reciprocating member which lifts the ampoules and permits them to flow singly on to the " cakewalk " conveyor. Ampoules are fed in rotation

to the screen printing head which has fully variable squeegee and screen pitch adjustment. During the printing operation the ampoule is rotated while the image is being applied. The rotating movement continues after printing and during the entry into the furnace. The furnace is fed by a completely new method, consisting of two parallel rods finished as worm screws, one accepting the bases and the other the necks of the containers. These worms reach right through the furnace and remain in the furnace at all times. As they urge the ampoules through the furnace, the worms also continue the rotating movement of the ampoules so that the distribution of the colour and of the heat treatment is always even. The worm feed also results in much closer ranging of the ampoules in the furnace, thus making full use of the heated area and putting more products into a smaller furnace.

Users of the Ardenghi machine can obtain service and spares from the Newman organisation.

PAPER COATING EMULSION

Vinamul R2912 is a low cost acrylic copolymer emulsion which has been developed specially for the mineral coating of paper. It is used as a partial replacement for starch, casein and other natural binders in both on-machine and off-machine coating.

The use of this material improves the pick, smoothness and wet-rub resistance of coatings bound with starch or casein, thus producing papers of excellent printability; it also increases their flexibility and varnish hold-out. The coated papers have excellent colour and can be calendered to exceptionally high gloss, it is claimed.

Being based on a fully saturated resin, the coatings do not suffer from the effects of ageing which are frequently associated with unsaturated butadiene copolymer latices; another advantage of the acrylic emulsion is its low odour.

The controlled particle size of this material ensures that there are no variations in pigment binding power. The coating compositions have low viscosities at high solids contents, and the viscosity of the emulsion itself is stable over a wide *p*H range.

The emulsion has excellent chemical stability; it can be used with china clay, titanium dioxide, precipitated calcium carbonate and even satin white without showing undesirable rheological properties. It is compatible with casein, and can be used with starch without the necessity of including a protective colloid as a stabiliser.

Both the emulsion and compositions based on it are stable to repeated freezing and thawing; coated papers made from accidentally frozen emulsion are therefore unimpaired in quality. In addition, systems containing it are claimed to have outstanding mechanical stability, and can be used under conditions of high shear as in mixing, pumping and coating operations.

Three types of flexible liner—*polyethylene, PVC or rubber latex—are available with a new 5 gal. liquid carrying fibre drum by Venesta Plywood Ltd. The liquid carrier features a novel method of seaming on the metal ends which leaves the interior free from projections. The retractable pouring spout shown is standard with the latex liner, optional with polyethylene or PVC.*

DRUMS WITH PLASTIC CLOSURES

Little John Drums, the cylindrical cardboard containers made by Robinson and Sons Ltd., can now be supplied with plastic closures, in addition to the tin-plate range. The drum is finished at the top and base with a rolled bead, and the closure, whether it be plastic or tin-plate, provides a snap fit behind the top bead, thus providing a drum which has a re-sealable lid.

The plastic closures range from ½ in. to 2 in. diameter in the standard range and two sizes can be offered with perforations, making the drum suitable for the dredging or sprinkling of powders. Perforations are covered with a card disc, which is sealed into a moulded cavity. This card can easily be removed when the sprinkler is required.

Moulded from high-impact polystyrene, *Styron*, the closures are finished in a neutral ivory colour. The lid fitting whilst effecting a retention of the closure in the drum, allows easy removal and replacement. It is also essential to ensure that no leakage occurs when fine powders are packed and the fit tolerance is limited to 0·004 in.

GREATER MOISTURE PROTECTION WITH NEW DRUMS

A new series of metal-ended fibre drums covering a wide range of dry and near-dry packaging uses has been introduced by Venesta Plywood Ltd. A new method has been used for seaming the pressed steel bottom of the container on to the fibre body tube. The raised edge of the bottom, fitting outside the end of the fibre body, is clinched into the the fibreboard without riveting or stitching.

This gives a strong and durable join with no perforations in the fibre body wall. Protection against moisture is thus increased; it can be raised still further by the inclusion of rubber or plastic sealing gaskets when the end is seamed on.

Both base and lid are normally made from 27 or 28 gauge steel, finished with a stoved-on epoxide lacquer, and are shaped to provide both secure stacking and maximum impact strength. A raised annular bead in the lid matches and indentation in the base.

For 10 in. diameter drums, the lids are made with a rolled, beaded rim which gives only a shallow overlap on the end of the body wall but has considerable rigidity. On the larger sizes a slightly different pattern lid with a deep straight flange is normally fitted.

Three types of fibre body are available. Basically the tube is wound from chipboard and kraft, fully glued between each lamination, with an outer surface of either natural kraft or a "standard" green which provides a good base for screen printing or stencilling.

For greater resistance to moisture and grease, the basic construction can be reinforced by the addition of aluminium foil. This can be applied by Venesta in one of three ways:

(1) Bonded to the inner wall of the drum body to provide an integral, moisture and greaseproof lining;

(2) Laminated between the separate plies of the wall during winding;

(3) Laminated to the outer wall to give, in addition to its protective properties, a bright metallic finish that can be lacquered to look even more attractive.

Similarly, a construction that is virtually inert chemically as well as moisture resistant can be obtained by combining the kraft with polethylene film.

The new *Vendrums* are being made in three internal diameters—14¼ in., 12 in. and 10 in.—with bodies of any length up to 38 in. Other diameters can be produced for reasonably large-quantity orders.

SEMI-AUTOMATIC LABELLING

The Newman *24A* is a simple and compact semi-automatic labelling machine, capable of handling the full range of containers from tiny tablet bottles to 40 oz. jars. It can apply to a 4 in. diameter jar a label 5⅛ in. high × 5⅝ in. wide at a height of 6¼ in. from jar base to label top. Output is up to 40/min.

Special care has been taken to ensure its suitability for heavy duty. The main slide bearings for the gum plate carrier are two large-diameter hardened steel liners. Again on the vertical movement of the bottle rest, hardened steel bushes are used and the pivot bush for this operating lever has been lengthened, flanged and increased in diameter. All cam faces are ½ in. wide.

The labels are pre-cut and stacked in a simple gravity fed label box. The gum plate passing underneath the label box receives the label box as the latter descends, and retains the lowest label by adhesion. The label is then carried forward over the bottle, held on by a descending grip-finger and pressed onto the bottle by a pair of pressers. The operator then removes the labelled bottle with one hand and feeds in a new bottle with the other. The machine can also label bottles where between one-third and two-thirds of the circumference is covered.

To cover a wide range of containers and labels, some extra fitments are required. These are quickly changeable, as well as each being capable of handling a limited range of sizes, either with or without adjustment.

Features of this machine are its small overall size (25 in. × 32 in. × 23 in.) and its low weight (204 lb.), which makes it a really portable bench model. It needs no bolting down and its ¼ h.p. motor needs only a 5A. plug.

The Model 24A is one of a range of eight labelling machines made by Newman Labelling Machines Ltd.

Seamed-on steel bottom, *joined to the fibre body wall without riveting or stitching, is a feature of this new drum for dry goods packaging introduced recently by Venesta Plywoods Ltd. Both base and lid are specially shaped to provide safe stacking and maximum impact resistance.*

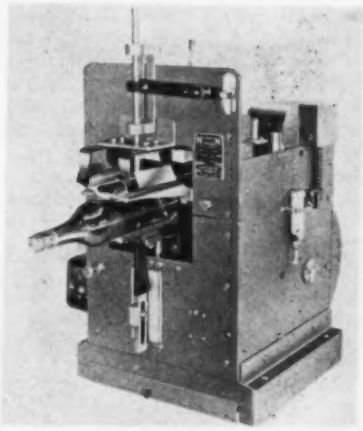
BOTTLE SEALING MACHINES

The Type R.B. machine made by Metal Closures Ltd. is a high-speed rotary sealing machine with five sealing heads rotating on a central spindle. The bottles travel through the machine continuously, giving stability and smooth running. Irregularly shaped and top-heavy bottles can be dealt with using a variable pitch scroll worm screw feed. Speed synchronisation with other machines in the bottling line can be achieved.

The machine will take bottles from 2 in. to 12 in. high with a 4 in. maximum diameter. Cap sizes are up to 70 mm. and the average output is 200 bottles/min.

The electric motor is normally arranged to suit three phase supply, and being housed under the main machine frame, is drip-proof. It can also be supplied totally enclosed or flame-proof.

Apart from the standard conveyor table, various optional extensions, turntable and other adaptations to facilitate incorporation into existing or new fully automatic bottling lines are available, either for working from left-to-right or from right-to-left.



Semi-automatic labelling *machine capable of handling the full range of containers from tablet bottles to 40 oz. jars. The manufacturers are Newman Labelling Machines Ltd.*

SOLUBLE PACKS FOR DETERGENTS

Soluble film packaging for bleaches and detergents is becoming popular in the United States, where it is estimated that this year about 1 million lb. of water-soluble plastic film will be used for packaging. *Tide Redi-Paks* (Procter and Gamble), *Swerl* detergent (Colgate) and *Lestair* dry bleach (Adell Chemical) are the three foremost products packed in soluble film. Polyvinyl alcohol is the most widely used plastic; it is strong, clear, solvent-resistant and impermeable to most gases. But it must be cast (extrusion would be cheaper) and it gets brittle at low temperatures and tends to crack. Attempts are being made to cure this problem.

Another soluble film is made from polyethylene oxide. It softens at lower temperatures than PVA but remains flexible down to −50°F. It can be fabricated by calendering or extrusion. Another resin being used is methyl cellulose, but this is not so soluble in hot water as PVA. But methyl cellulose has F.D.A. approval for food packs.

The possibilities of soluble film packs are almost endless and include detergents, bleaches, dyes and agricultural chemicals. Cost of the plastic is about 1·85 dollars per lb., roughly 10 dollars for 1,000 packages.

It might be possible to develop

packages with controlled solubility. Because of selective solution rates of the packages, the materials they contain would be added to a reaction in a desired sequence; a minor component of the formulation could be included in the packaging film. The disadvantage of soluble packs is that no size is correct for every use. Many housewives may prefer to measure their own materials rather than have it done for them.

Soluble film packaging was discussed at the annual meeting of the Chemical Specialties Manufacturers Association recently. (*Chemical and Engineering News*, 1960, **38** (51), 28.)

GLASS PACKAGING ADVICE

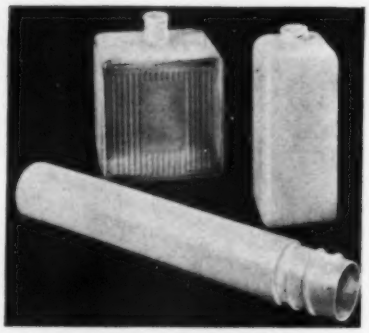
An innovation in glass packaging is the inauguration of a packaging advisory service to deal with problems of container design, closure, product identification, ease of filling, capping and labelling—and of emptying. This comprehensive service has been set up by Jackson Bros. (of Knottingley) Ltd., and its operation has been described by Duncan Sutcliffe, Jackson's commercial manager, as follows:

Suppose, for example, a producer wishes to market a new line which will, in the early stages, be offered in units of 6 fluid oz. He intends eventually to put out several sizes of container and plans to reach his public through all the normal channels. This, with a possible examination of the proposed advertising and point of sale material, is the sum total of information.

The Jackson group, then presents the prospective client with several alternative designs in the form of artist's drawings and clear perspex models, each of actual size and showing the shape of label and type of closure most suited to the design. The factors governing each design are:

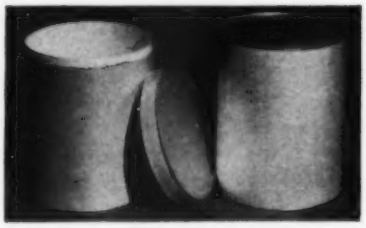
Competitors' packs;
product identification;
speed and ease of filling, labelling and capping;
product inspection;
ease of removal of contents;
stackability;
speed and economy of production;
integral strength.

Having made his choice, the client may then receive advice on processing, on the printing and application of labels and on the installation of filling and capping lines. Market research findings are employed where necessary to determine other details, such as the relative prominence of brand and product titling.



AUTOMATIC PRODUCTION OF POLYTHENE CONTAINERS

Coinciding with the opening of their new factory, Fibrenyle Ltd. have just installed the first of three Blowmaster Type 10 *blow moulding machines. These machines are the first of their kind to produce large polythene containers automatically. Capable of producing containers of up to 9 in. diameter by 20 in. high, these machines now make it possible for a high rate of production at most economic prices. The illustration shows three typical examples. That in the foreground is 20 in. long by 3 in. diameter; to the right (in H.D. polythene), is 4 in. square by 10 in. high; and to the left (thin wall), 7 in. square by 9 in. high.*



NEW COMPOSITE DRUMS

A wide selection of 8 in. diameter composite drums are being marketed by the Paper Group of the Metal Box Co. Ltd.

The drums have tinplate ends and the bodies may be made of waterproof cartridge paper, American kraft liner or high-quality chipboard. They are available in three styles—a string opening throwaway drum, a string opening re-closure type and a slip lid type.

For the re-closure string opening style, the height range is 3 in. to 20 in. and for the throwaway or slip lid styles 2 in. to 20 in. A wide range of wall thicknesses may be achieved according to requirements.

The drums can be used for chemical and pharmaceutical powders, confectionery and dry foodstuffs, bakers' sundries and chemical pastes. Additional protection against grease and moisture penetration may be given by wax lamination or the use of foil.

Reed Plastic Packaging

Albert E. Reed and Co. Ltd. is extending its interests in packaging and has entered the field of plastic containers by establishing a company called Reed Plastic Packaging Ltd.

Reed will hold 60% of the capital of the company, the remainder being held by Polythene Drums Ltd., of Middlesex, whose proprietors have agreed to merge their interests in packaging with those of the Reed Paper Group.

Managing director will be Mr. F. J. Clark (a director of Albert E. Reed and chief executive of the Reed Packaging Division).

Packaging machine makers merger

A merger has been arranged between Baker Perkins Ltd. (which has interests in the wrapping and packaging machinery industry through its wholly-owned subsidiary, the Forgrove Machinery Co. Ltd. and Rose Brothers (Gainsborough) Ltd., designers and manufacturers of an extensive range of packaging machines.

The products of both companies are largely complementary and the combined technical and manufacturing capacities will enable greater strides to be made in the development, supply and service of wrapping and packaging machinery.

Mr. H. S. Ridley will continue as chairman of Rose Brothers and all executive directors will continue in office. It is envisaged that Mr. A. I. Baker, chairman of Baker Perkins Ltd., together with N. Mountain and R. H. Wilkins, directors of Baker Perkins Ltd., and W. A. B. Brown, deputy managing director of Forgrove, will join the board of Rose Brothers.

Rose Brothers, who have been making packaging machines since 1880, have factories at Gainsborough, Leeds, Saxilby and Skegness; Forgrove was established in 1901 and has two factories in Leeds and a third at Gateshead.

GLASS FIGHTS BACK

(Continued from opposite page)

It is always useful to refer to the trend in the American glass industry as a possible guide to the future pattern of demand to be expected in the U.K. Of the total sales of glass containers in the U.S.A. about 8% or 1,650 million units are accounted for by industries producing household goods and industrial chemicals. In the U.K. the comparable figures amount approximately to 5% and 200 million.

It seems probable therefore, both from these figures and from the recent research undertaken in this country, that the future will see a greater use of glass for household products and other goods in the U.K.

Glass Fights Back

How the Glass Container Industry is Meeting the Challenge of Plastics and Cans

By Rowena Mills

THE U.K. is the third largest producer of glass containers in the world, and the past half-century has seen an eight-fold increase in British output.

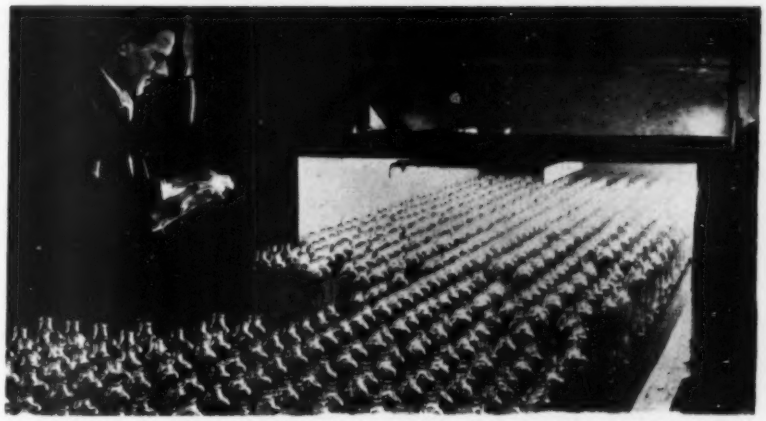
Just after the end of the 1914-18 war the total supply of bottles and jars amounted to some 560 million. By the eve of the second World War this had trebled; by 1948 output had reached a level of some 2,816 million units. Almost each year since has seen a further increase in output, and even in 1958 when general industrial activity declined, output continued to rise. In 1959 with the general improvement in the economic climate sales rose once again to a new record level of 4,157 million units.

Of the total annual sales of glass containers to industry, as much as 90% is absorbed by four major industries—those processing and packaging food (including milk); all types of drinks; medical goods and drugs; and lastly toilet goods and cosmetics. In 1958 the percentage of total sales accounted for by each of these industries amounted to 37·7%, 29·2%, 18·6% and 7·4% respectively.

Direct exports were relatively small, but indirect exports in the form of filled containers, although difficult to assess, were very substantial indeed.

Competition from plastics

Glass manufacturers have, in recent years, met increasing competition both from the newer plastics industries and also from traditional industries such as those producing cans which have been endeavouring to broaden their sphere of activity. To counter this the weight of bottles has been reduced (to as little as two-thirds its prewar level) and at the same time the design has changed to give increased resistance in use. In conjunction with packers and food machinery manufacturers, methods of filling, sealing, washing, crating and labelling have been speeded up and made more efficient. Attention has also been paid to eye appeal and improved designs.



Thousands of bottles entering the annealing furnace for treatment. This relieves any undesirable stresses.

As a result, glass has succeeded not only in maintaining its position, but in certain fields its use in packaging has increased. Moreover, the results of a recent survey among consumers, manufacturers and retailers indicate that for a number of articles many people would like to see glass used more widely.

Consumer preferences

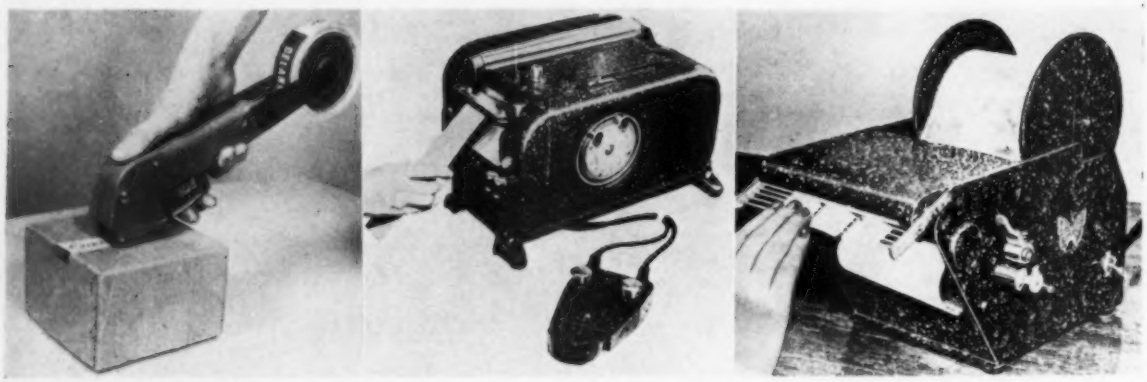
Among these are a variety of household products including polishes, cleansers, bleaches and liquid detergents. Many of the consumers questioned stated that in their opinion the glass bottle or jar was a suitable pack for products of this nature. This preference was based on a variety of factors. First there appears to be a general feeling that this type of product is "safe" in a glass container because there is no danger of reaction between the glass and any chemical ingredients. The transparency of the bottle is felt to be important since it makes the product easily identifiable and the consumer can see at a glance just how much has been used up. The fresh and clean appearance of the glass was also praised and many consumers commented favourably on bottles specially shaped to help in safe handling with wet hands.

Much the same reasons were put forward by the product manufacturers, and many of them stated that due to its chemical inertness, impermeability and ability to withstand pressure it was the only suitable pack for many products. Cost was also an important factor and it was pointed out that glass compared favourably with many new packs now being marketed. Retailers also reported favourably on glass bottles, particularly the prestige and display value.

(*Concluded on opposite page*)

Glass bottles 1,500 B.C.

Glass has been known for thousands of years and was probably first used as a glaze to make stones resemble precious gems. The first glass containers were those produced by the ancient Egyptians around 1,500 B.C. They were made by winding threads of molten glass around a hard core of sand and clay which was later removed when the glass hardened. The first blown glass bottles were produced, probably in Alexandria, just before the birth of Christ; the Romans used these mainly for medicines and perfumes. By the thirteenth century the technique had spread and the industry was firmly established in Britain.



(Left) Portable self-adhesive tape dispenser; (centre) tape-shooter showing foot pedal control; (right) electric tacky labeller dispenser

Labelling and Sealing; New Materials and Machines

By Frederick T. Day

MAKERS of labelling and sealing papers and tapes continue to provide quicker and more efficient means of branding, sealing, labelling and coding pharmaceutical products. In recent weeks, they and the makers of fibreboard cases and containers have set up an advisory service for the packager so that tests on every aspect of both packaging the product and the housing of a number of units may be discussed and prototype containers and cases made so that physical tests may be carried out.

Label papers

New "quicktac" label papers have been introduced which, when printed either in unit form or on the continuous reel, may be used as end labels and brand and seal labels for sealing the folded ends of packets and cartons. Many types of carton material are very springy at the fold or flap and firm closure may be difficult with ordinary adhesive labels. Quicktac recipes may be used in liquid adhesives for sealing flaps, in addition to labelling. A "superstick" coated label paper will stand up to freezing and is suitable for labelling packs exported to cold climates. Tropical gummed label papers may be used for labelling products destined for hot and humid climates.

For the packaging department equipped with machinery for printing labels, new autofeed non-curling dextrine and gum arabic label papers have been introduced. This grade runs fast on the press and assists in the production of special sizes and shapes as it will punch out under the cutters or press very much better than ordinary adhesive papers. There are no broken edges and no edge clinging; furthermore, cutters and dies do not blunt so quickly as is often the case where other types of papers are used.

Advances have been made in specialised heatfix coatings to prevent labels blocking in conditions of high humidity. Of special interest is *Delatac*—a delayed action heatfix label paper. This recipe may now be strip coated on to most base papers, in any width strip from a minimum of $\frac{3}{4}$ in. The applied strips may be positioned at any required interval along the sheet or reel and this opens up a new approach to overwrapping, end or seam sealing wraps and similar packaging projects. These label papers may be used in cases where heat must not be applied to the packs.

New types of pressure sensitive label papers and tapes stick to waxed surfaces, glass containers, plastics, metal and tinplate, wood and paper and card based boxes. No residue is left on the surface of the product. The new development in pressure sensitive labels is "tackytite"; it provides fast and permanent labelling. It is particularly suitable for such materials as flexible and rigid polythene and will stand freezing.

New types of release coated papers and barrier coated media may soon be available for testing. New synthetic resin coatings provide a barrier against moisture, moisture-vapour, grease, odour transmission and other undesirable features. Such coatings are non-toxic, flexible and strong. New papers coated with vinyl resins have outstanding barrier properties for sachet manufacture and for over-wrapping hygroscopic products.

Hand and automatic machines

Larger labellers are being introduced which will moisten gummed labels of every kind up to a width of 18 in. Up to date, the maximum moistening width has been 9 in. New electric labellers are now available which moisten and automatically dispense labels ready for application. All adhesive coated labels are best moistened mechanically to ensure good adhesion.

Tapes and sealing machines

New Fibreglass, sisal, creped sisal, non-bitumen reinforced tapes and cambrics all form part of the latest series of tenacious and strong tapes

used for carton, tins, container and packing case sealing. Cellulose, transparent and coloured, self-adhesive tapes may be printed in four colours and these are now applied by new machines which cut off suitable lengths for sealing and packaging.

A new high-speed electric " tape-shooter " is worked by foot pedal, leaving both hands of the packer free to apply the tape. It will cut the toughest and strongest tapes in any width up to 4 in.; wider tape machines are on the way. Two predetermined lengths of tape may be set and dispensed as required at any length between 4 in. and 50 in. so that all sizes, shapes and weights of containers, packing cases and bales may be conveniently handled. An electric element is fitted to this new machine's water tank, thus ensuring a speedy penetration of moisture to adhesive or glued surfaces.

The new electric " tacky labeller " has been introduced for applying labels of this type and will automatically strip the backing paper from a row of labels, placing them to hand for immediate use. A simple adjustment may be made to dispense labels of various sizes. Any shape or size label may be used. A heating element may be incorporated in the machine which occupies only 9¼ in. by 7 in. The waste backing sheet may be fed away into a bin.

Of special interest to the packager and stock keeper is the portable " tackytaper " hand-operated sealing machine which may be carried round the store for sealing or re-sealing opened cases. Finger pressure releases a length of tape which may be applied direct.

Gland packings and their choice for any combination of service conditions are described in a new reference book compiled by Crane Packing Ltd. An equipment code which is reproduced as a bookmark flap provides an at-a-glance reference to the equipment for which each gland packing is suitable. Alongside each gland packing there are code letters to complete the reference. The main reference sections number 9; and in the sections gland packings are grouped under headings which relate to the maximum temperatures at which they can be used.

Aluminium Foil Packs for Surgical Sutures

By L. W. Swann*

CONSTANT attention is being given by pharmaceutical manufacturers to sterilisation and to the problems that arise when this has to be undertaken in conjunction with packaging; for it is one thing to make a medical product sterile, and another to distribute and stock it in a completely uncontaminated state until the very moment of its use. Fisher's Foils Ltd. have recently been giving attention to the sterilisation and marketing of sutures and ligatures, which have hitherto presented certain difficulties.

The method so far adopted for catgut absorbable surgical sutures is to dehydrate them slowly in glass containers, which are then filled with a sterile liquid, sealed, and sterilised by autoclaving. For some time now there has been a desire for a flexible pack to contain these sutures. The aim is to place them in the pack and then sterilise it. Difficulties have been encountered during sterilisation, which, for non-absorbable nylon sutures, is usually done by steam at 120°C.; and for absorbable sutures, by the vapour of a non-aqueous organic fluid at rather higher temperatures. In the case of the catgut absorbable sutures, the internal surface of the pack must resist prolonged contact with alcohol in which the suture must be kept until use.

Aluminium foil would provide an excellent medium for the flexible pack. The problem at present engaging attention is that of finding a sealing medium with which to coat the foil for holding the pack together, and which will at once resist high and prolonged autoclaving temperatures, and, in the case of the absorbable catgut sutures, the alcohol contained within the pack. A heat-sealing medium for use in conjunction with foil is usually thought to be a coating or a laminated film. Few, if any, at present available could fulfil the exacting conditions over the necessary period.

One might consider the adoption of an unlaminated or uncoated foil of not less than 0·002 in. gauge and to produce the sachet pack by welding. Of the several methods technically possible, pressure welding and resistance welding would call for plant rather heavy for the job in hand. Ultrasonic welding would seem to offer the advantages of comparatively light-weight equipment and cleanness.

* Fisher Foils Ltd.

Sterilising by radiation

Progress in another direction may overcome these problems. Successful development of sterilisation by ionising radiation has been achieved at the Wantage Radiation Laboratory in Berkshire. A plant has been constructed there for demonstrating to British industry the advantages of bulk over batch sterilisation.

Ionising radiation for this type of work is now of two types—gamma radiation and electrons up to about 5 MeV. By neither could radioactivity be induced in the product irradiated. Much work has been done at Wantage to determine the dose necessary to destroy the undesired micro-organisms. Experiment has shown that a dose of 2·5 millionrad is sufficient with a margin of safety under most conditions (see D. B. Powell, MANUFACTURING CHEMIST, November 1959, pp. 435 and the A.B.P.I. report, *idem* August 1960, p. 361 and September 1960, p. 373.)

In a paper, " Sterilisation of Medical and Pharmaceutical Products," by Powell and Bridges (*Research*, 1960, **13,** 151-7), reprints of which are available, the authors make recommendations concerning packaging materials as follows. " All plastic films such as cellophane, cellulose acetate, polythene, nylon, and of course metal foils are suitable at sterilisation doses." After pointing out that few packaging materials have all the essential properties for every application, the writers state that an aluminium foil-plastic laminate has been found most suitable for sutures. Indeed, radiation-sterilised sutures are already being produced in America packed in this medium. (See MANUFACTURING CHEMIST, November 1959, p. 440.)

American Commentary

NEWS AND VIEWS OF THE U.S. PHARMACEUTICAL INDUSTRY **by Rolf Silken**

Full disclosure of prescription formulæ—a great boon for foreign competitors ★ Factory inspection mandatory for NDA approval ★ FDA's new pharmaceutical promotion regulations ★ Sales of human drugs for animal use now controlled.

SO many regulations and policies of the FDA (Food and Drug Administration) are becoming effective just now that I devote this report to them exclusively.

Many of the changes were expected, others came as a surprise. Even though the pharmaceutical industry and doctors were asking for alterations repeatedly in 1960, the FDA has given consideration to only a few of them.

New labelling rules

Among the new regulations are those requiring drastic changes in the labelling and promotion of prescription drugs. They became effective on January 8, with the exception of the ruling dealing with certain label disclosures which becomes effective on March 9.

Henceforth all prescription drugs *i.e.* those whose labels carry the so-called "prescription legend" (a caution statement declaring "Federal law prohibits dispensing without prescription" of a physician or veterinarian) must now include full information about hazards, side-effects, and conditions in which the drug should not be used. Whenever possible, this information must appear on the labels and more details may be supplied in all promotional literature, package inserts, advertisements (with the exception of those appearing in professional journals, but not in house organs). All supplementary labelling of this type must also include the complete label information—product's name, firm's name and address, indications, formula, directions, dosage, cautions, and warnings!

Many if not most of the new drugs —those marketed after approval of an NDA (New Drug Application)— and also older, highly effective preparations are limited to prescription sales. Examples are antibiotics, antihistamines, many sulphonamides amphetamine and other antidepressants, all barbiturates, anæsthetics, the true tranquillisers, vasodilators, hormones, antispasmodics, many diuretics, etc.—even some of the more potent vitamin preparations, cough remedies and analgesics. For all these prescription drugs, the labels will soon have to disclose qualitatively and quantitatively not only the active ingredients, but also the inert ingredients.

Pirating possibilities

I think this is the most dangerous part of the new regulations for America's pharmaceutical industry. It forces the disclosure of the trade secrets of the industry. I'm surprised that this danger has not been discussed widely when there was time to do something about it. Maybe this is due to the fact that the damage will not be felt as much within the U.S.A. (where the NDA and patent laws provide some protection from duplicators) as abroad. I predict that foreign firms will soon find that they can save fortunes by studying the fully disclosed composition of the most valuable and latest American drugs. And I foresee a reversal of the American trend of sending observers abroad to obtain first-hand information on new research developments and possibilities for collaboration or in other words, competition.

I predict that some of the large European firms will now employ alert observers on the American scene—experts who will be able to give them all the needed information about the composition as well as efficacy and side-effects of new drugs. The samples, working formulæ and literature, and even the available source material, can be obtained legally and sent abroad to those who do not have to pay attention to the American patent rights, nor the NDA regulations and other sections of the FD&C (Food, Drug and Cosmetic) Act.

Factory control

Other provisions of the new FDA regulations involve strict factory controls, which include manufacturing procedures, equipment, control-laboratory methods, and all records pertaining to the research and development of any new drug. The FDA can deny approval of an NDA if the manufacturer does not collaborate with the FDA inspector before this drug can be marketed.

Strict rules

Other new provisions demand that the labels of prescription drugs carry identifying lot numbers; that advertising material of a new drug, as well as its promotion by salesmen, must be limited to the claims and information made in the labelling approved by the FDA; that all promotional material show the date of issue or latest revision; and that ophthalmic preparations (which must be sterile) declare quantitatively and qualitatively their active ingredients and (only) qualitatively the inert ingredients.

Not for the dog

Another new regulation prohibits drugs labelled for human use being promoted also for veterinary use. In future, if such human-use drugs are supplied to veterinarians or animal owners, they must be accompanied by literature giving specific directions for use in the animal species, including hazards, withdrawal time, etc.

In the past, pet animals in particular were often treated with human-use drugs. Many veterinarians and druggists like "double duty" drugs because there is a much larger selection of "good-looking" pills and other attractively packaged drugs available for use by humans than could be supplied by the veterinary pharmaceutical firms. The medium-sized dog's dose is often considered identical with an average-sized man's dose. Thus, human houses took away from the veterinary sector millions of dollars without investing in veterinary research. Now they will have to do toxicity, safety, and efficacy tests on various animals before being permitted to recommend their human drugs for veterinary use.

▶DENSIFICATION OF POWDERS

The *Vacupress* plant for the densification of powders operates on the principle of continuous de-aeration with pressure, controls enabling the final bulk density to be set. It is claimed that while increasing the bulk density none of the properties of powders and finely milled substances are lost.

Four sizes are available with capacities from a few hundred pounds per hour to over a ton per hour depending on the original bulk density. Several tons per hour is possible for materials in powder form with higher initial bulk densities. The machines can also be made portable, enabling one machine to be used for several process plants.

Successful operation is claimed for most chemicals, including low bulk density silicates, carbon blacks, colour pigments, P.V.C. powder and kieselguhr.

A. H. Wright, 60 Falconwood Road, Addington, Surrey, is the exclusive supplier of the Vacupress for the United Kingdom and the Commonwealth.

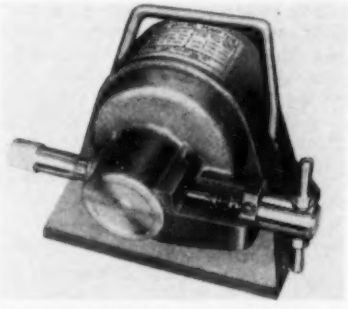
▶MICRO PUMPING

A new micro metering pump is available in a range of capacities—the smallest from zero to 100 c.c./hr. and the largest from zero to 1,500 c.c./hr.—controlled by micrometer adjustment. The standard plunger heads are constructed in 18/8/3 stainless steel. Diaphragm heads in a wide range of materials are also available.

The motor assembly for the single and duplex pumps is identical and the pump can be used either with one head or, by the addition of a second pumping head, be converted into a duplex pump. The heads, which operate 180° out of phase, improve flow characteristics if they are coupled in parallel. Alternatively, the two heads of the duplex pump can be used independently, both being controlled for ouput by micrometer adjustment.

The price of the new pump with plunger head is £75 and of the plug-in transformer with 8 ft. of lead is £4 10s. At present the pumps are available in standard materials from stock.

The manufacturers are the Distillers Co. Ltd., who make a number of metering pumps.



Micro metering pump made by the Distillers Co. Ltd. It is available in capacities from 0 to 100 c.c./hr. and 0 to 1,500 c.c./hr.

▶OSCILLATING GRANULATOR

In this machine made by Manesty Machines Ltd. a rotor, which consists of bars arranged cylindrically oscillates over a woven wire mesh screen and forces material through it. The screens are interchangeable.

A hopper is arranged above the rotor and the material drops by gravity through the spaces between the bars of the rotor. The hopper, rotor and all other parts in contact with the material being processed are of stainless steel.

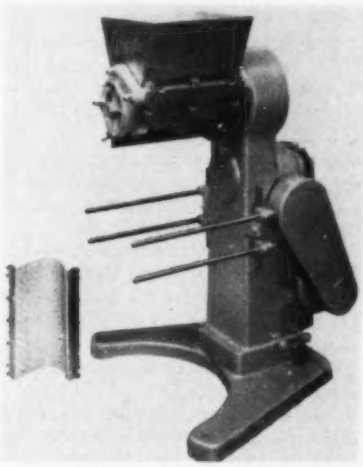
The screen holding arrangements are carefully designed to ensure that even tension is applied across the mesh.

This machine can be used to reduce both wet and dry materials, and has many uses in the pharmaceutical, ceramics, powdered metal and food industries.

▶METERING PUMP

Metering pumps are being increasingly used in the chemical industry. One firm of manufacturing chemists in their Stockport plant have successfully used a *Metripump* for one particular application. Use of this pump, one of the G type, has resulted in a more compact layout, increased production and simpler operation. Plant supervision has been reduced and the possibility of human error in the control of the additives practically eliminated.

The plant installed was required to carry out a reaction involving the simultaneous addition of two major raw materials in a fixed ratio,



Oscillating granulator for reducing both wet and dry materials. Screens are interchangeable. The makers are Manesty Machines Ltd.

over a period of about 5 hr. The two materials could not be mixed before they entered the reaction vessel.

On the experimental production unit this was achieved by breaking the additives down into separate distinct parts. Small measuring tanks, fitted between the storage tanks and the reaction vessel, were filled automatically by the use of float switches and magnetic valves. The total contents of the measuring vessels were then added to the reaction vessel *via* needle control valves. Thus at the end of each distinct addition the correct quantities of the raw materials had been added despite possible variations in rate during the addition.

This system, although used for about two years, was complex and the needle and magnetic valves and the float switches required considerable attention.

A larger plant was designed to replace the experimental set-up and ways were sought of improving the method of additions. On the new plant the measuring tanks, magnetic valves and the float switches have been replaced by one duplex metering pump which gives a continuous feed of the two raw materials in a constant fixed ratio, although the overall rate of addition is infinitely variable. This system has now been running for three months and the

metering pump has handled about 40,000 gal. of the raw materials without failure.

▶JET PULVERISER

The *Micronizer* mill, developed by F. W. Berk and Co. Ltd., is capable of grinding dry solids to particle ranges down to 5 microns and below.

Reduction is effected by the material grinding upon itself; energy required to set up the attrition is supplied by any compressed gas or superheated steam.

This technique provides advantages over conventional mills, where the properties of the materials do not permit ordinary grinding. Easily cleaned, it can, by simple change of components, be readily adapted for several uses.

Materials that can be processed include antibiotics and pharmaceutical products. The Micronizer is operated under sterile conditions and without risk of contamination. It is excellent blending apparatus, as little as 0·25% of additives can be distributed throughout the bulk.

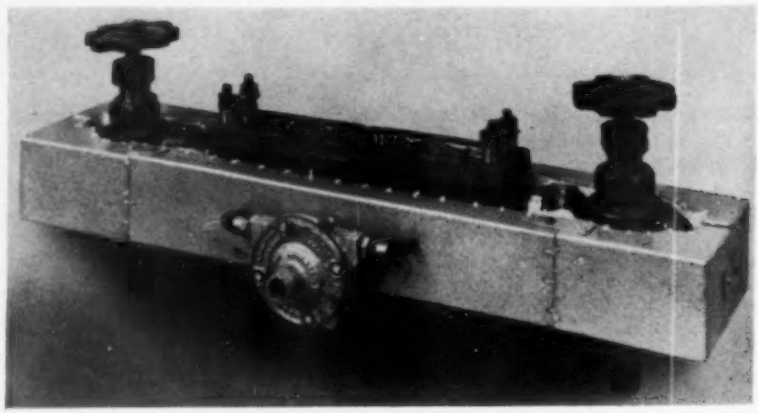
Material to be micronized is injected into the grinding chamber. Compressed gas is expanded into the chamber through jet nozzles, which, spaced around the periphery of the grinding chamber, maintain a high speed of rotation. Solids, accelerated by the rotating gas, are thrown to the periphery, where a portion, coming into the zone of the nozzles, is further accelerated tangentially and radially inwards. This causes violent impacts with other particles circulating in the grinding chamber.

The resulting fines are collected and classified by the rotating gas and conveyed towards the central outlet. This intense classifying action returns oversize particles to the grinding zone, while the exhaust gas carries the predetermined finer particles to the outlet. The solids are extracted from the exhaust gas by an integral cyclone collector beneath the mill or separated from it. A high degree of collection efficiency is obtained (96% to 99%) by preserving the speed of the exhaust gases. Exhaust gas is then passed to a filter, or condenser, if steam is used, where the low quantity of entrained solids is extracted. Wear in the grinding chamber is extremely low even when grinding particularly abrasive substancies.

These mills are constructed in materials suitable to their applications and interchangeable inner plates can be supplied.

The range of micronizers includes 2 in. and 4 in. laboratory models and from 8 in. to 36 in. production models.

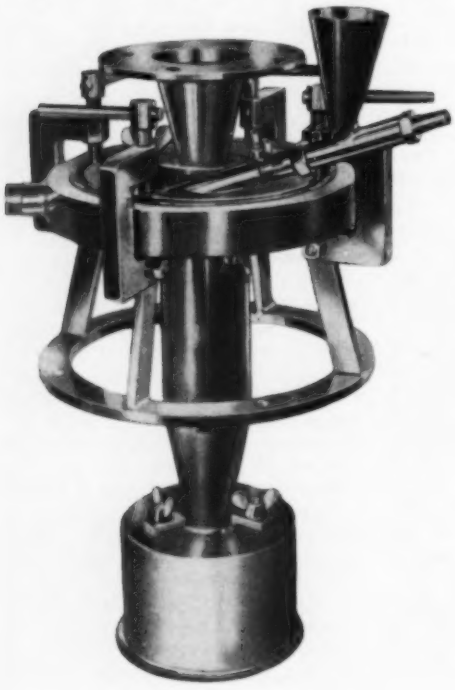
Outputs vary from ½ lb. to 4 lb. per hr. with the 2 in. model, to 10 lb. for the 4 in. model and from 20 lb. to 3,500 lb. per hr. for the large range of production models.



ISOMANTLE FOR SIGHT GLASSES

A Jerguson sight glass with two coupling valves heated by a flameproof Isomantle *made by Isopad Ltd. Electric surface heating has proved to be an excellent alternative to steam heating and sometimes the only way to maintain gauges at the correct temperature to give accurate indication.*

The units provide frost protection in exposed conditions. Thermostatic and manual controls, flameproof and non-flameproof, are provided to suit each particular installation. Sight glasses for high temperatures have also been fitted. Similar units are applied to a large range of control instruments, flow meters, and all makes of valves.



Micronizer mill developed by F. W. Berk and Co. Ltd. for grinding dry solids to particle ranges down to 5 microns and below. Materials that can be processed include antibiotics and pharmaceutical products. The mill also acts as an efficient blender.

For more information about the plant and equipment described please use the coupon on page 96

Barrier creams useless?

Doctor's evidence in High Court

A recent report of a case in the High Court has thrown doubts on the effectiveness of industrial barrier creams in preventing dermatitis. Evidence given even stated that they probably did more harm than good.

The plaintiff, who was daily in contact with cement, grease and filth, alleged that no barrier cream had been provided by his firm, through which he contracted dermatitis. Part of the company's defence lay in the claim that even if he had used a barrier cream it would not have protected his hands from dermatitis.

Evidence for the defence was given by Dr. Ray Bettley in a letter in which he stated that the theory of barrier creams was a good one but the only proof of their value must come from properly conducted trials. He said that good evidence of this kind had never been produced and that their value was still based upon theory and the specious claims of those that made them. He summed up by saying that the value of a barrier cream was a matter only of presumption, and added that some dermatologists and industrial health officers considered the creams did more harm than good. The award was made in the defendant's favour.

Dr. Bettley enlarges on these remarks in a paper, "Some dermatological hazards of today" (*Brit. Med. J.*, 1960, **2,** 1467), where he quotes some 18 reports to support his views. He maintains that the practice of filling the pores with solid particles (*e.g.* kaolin, soap or fatty material) is acceptable only if these substances are less harmful and more easily removed than the dirt to which the skin is exposed. He says that the four formulæ suggested by the Barrier Substances Sub-Committee of the British Pharmaceutical Codex Revision Committee remain inefficiently tested and assessed. He contends that it should be made clear that protection from barrier creams is questionable, and manufacturers should publish evidence on which their claims are based as well as the formulæ of the products.

I.C.I. raise £34m. for new plants

For the first time for many years I.C.I. is raising money from its 300,000 shareholders. Last month the chairman, Mr. S. P. Chambers, announced a "rights" issue of new ordinary £1 shares. Between 12·5 million and 12·9 million will be issued to shareholders at 55s. each in the proportion of one new share for every 20 held. The market price of the shares at the time of the announcement of the new issue was 63s. 9d., so the rights are worth about 5d. per share.

Mr. Chambers said that between £34 million and £35 million will be raised by the new issue, which will be payable in two instalments, one on March 17 and the other on May 12. The money will be used not for a specific project but for financing several projects now under way, for example at Severnside, Wilton and Northern Ireland where a new Terylene plant is being built. At the end of 1960 the expansion schemes authorised amounted to £51 million. In spite of raising new money, I.C.I. will continue to finance most of its expansion from its own resources. In the last 16 years they have spent £535 million on expansion, of which £410 million came from within the company.

Mr. Chambers is optimistic about profits. Pre-tax profits for 1960 are provisionally put at £88m. against £73m. in 1959. These figures point to earnings of just under 30%, providing cover of a little over twice for the new dividend rate. The yield on the £1 ordinary shares at an assumed ex-rights price of 63s. is 4·3%.

Progress towards a vaccine for colds

A fresh appeal for volunteers to help with their experiments has been made by the Common Cold Research Unit of the Medical Research Council. Lack of volunteers is holding up experiments.

The M.R.C. say that 30 of the viruses which appear to cause colds have now been grown in test tubes and that nine of these have been tested in volunteers, all producing typical colds.

"Efforts are being made to grow the other viruses in new types of tissue cultures and, in order to test the success of these new methods, volunteers are urgently required," say the council.

Dr. D. A. J. Tyrrell, who is in charge of the unit's laboratories, said that only about one-third of the volunteers develop colds. The unit was concerned to find out why the other two-thirds did not. "One of the reasons seems to be that they have antibodies circulating in their blood, which we can now measure. We have also produced an infection from a cold virus that developed antibodies. The average person has a lot of colds, and the reason for this appears to be infection by a series of different viruses."

Although it had not yet been possible to make a vaccine, he added, the unit had made some progress. As people's own antibodies protected them from colds, they might be given antibodies artificially.

I.C.I. plan £4 million drug factory

Less than two weeks after the announcement that the company was to raise £34 million of fresh capital, I.C.I. disclosed plans to spend more than £4 million on building a giant new pharmaceutical factory at Macclesfield, Cheshire, near their Alderley Park Research Laboratories. At first several hundred people will find work there. Eventually some 2,000 will be employed making, packing and distributing pharmaceutical products.

At present I.C.I.'s pharmaceutical products are finished at its Regent Factory, Linlithgow, and the employees, and the officials of the Unions concerned, have been informed that the concentration of the Division's manufacturing activities in Cheshire will mean that the Linlithgow factory will have to close in two or three years' time. Similarly, smaller units at Grangemouth (Stirlingshire) and Oldham will ultimately be transferred to Macclesfield.

S.A.I. to spend £1·25m. on fertiliser expansion

Scottish Agricultural Industries, controlled by I.C.I. have authorised a £1,250,000 expansion programme. This will be spent on converting the Sandilands Works at Aberdeen from the production of compound fertilisers based upon superphosphate to the production of ammonium phosphate and the more concentrated compounds which can be made from it.

Continental drugs—illusory NHS savings?

Could N.H.S. savings be made by buying drugs from the Continent? This was the implication of a question in the House of Commons which was reported in MANUFACTURING CHEMIST last month (p. 32). The Minister of Health said that hospital purchases of foreign drugs were small.

The question prompted Mr. F. G. Stock of the Birmingham City Analytical Department to test 70 ampoules of 0·5 g. thiopentone injection made on the Continent and supplied by a British firm specialising in hospital contracts. Twenty ampoules failed to meet pharmacopœial requirements and in the whole series there was a variation of 32% between the heaviest and the lightest (591 to 448 mg.). Ten ampoules from a well-known British firm were compared and the difference was much smaller, being 485 and 509 mg. (*Pharmaceutical Journal*, 1961, (5071), 13.)

Lead makers bought up

The Firth Cleveland Group, through its subsidiary Firland Metals Ltd., has acquired Quirk, Barton and Burns (St. Helens) Ltd., of St. Helens, Lancs., manufacturers of sheet lead, lead pipe, solder, laminated lead and other products. The acquisition was made to reinforce R. E. Roberts and Son Ltd., of Bolton, another company in the Firth Cleveland lead division.

I.C.I. re-orient pure research lab.

I.C.I. are changing the administration and organisation of their Akers Research Laboratory.

This laboratory, located near Welwyn, was established 15 years ago to conduct general long range and fundamental research. Hitherto it has been administered centrally.

It has been decided to associate its work more closely with the research carried out by I.C.I.'s manufacturing divisions. To this end the two main activities of the laboratory—research on microbiology (with the associated research in organic chemistry) and research in inorganic chemistry—will, in future, be the responsibility of the pharmaceuticals and heavy organic chemicals divisions respectively. Dr. P. W. Brian, F.R.S., who becomes an associate research manager of the pharmaceuticals division, will have charge of the work for this division, and will also be in general charge of the laboratory.

Dr. J. Chatt will continue in charge of the inorganic chemistry department, and is appointed group manager of the heavy organic chemicals division.

The laboratory will continue to be a centre for exploratory research in the selected fields. While the type and general character of the laboratory work will be unchanged, it will be more aligned to the long-term interests of the company. The new organisation should facilitate the industrial development by other units of I.C.I. of new knowledge gained in the Akers Laboratory.

Extensions at I.C.I.'s silicone plant

West Plate distillation equipment for the third stage extensions to Imperial Chemical Industries' silicones plant at Ardeer, Scotland, has been supplied and erected by the A.P.V. Co. Ltd.

This equipment was required on site within four months of placing the order, so that it could be installed during the planned maintenance shutdown of existing plant. Close co-operation between A.P.V.'s and I.C.I.'s Engineering Departments ensured that the plant was delivered on time and that erection was completed within the short time allowed.

In addition to the above-mentioned plant, A.P.V. have also been asked to supply a methyl chloride vaporiser, several more West distillation and recovery columns with condensers and reboilers, and a reactor scrubbing column. Three of these distillation columns are being designed for continuous operation and the fourth will be a 2,000 gal. batch still. The close plate spacing made possible by the use of West Plates enables appreciable savings to be made in vessel costs, structural steelwork, foundation and interconnecting pipework, etc.

These are the second and third orders placed by I.C.I.'s Nobel Division for A.P.V. distillation equipment during recent years, the first order having been placed during 1956.

I.C.I. produce more plasticiser alcohols

I.C.I. is to increase its production of alcohols by the carbonylation of olefinic feedstocks. A fourth unit, with a capacity of 30,000 tons of plasticiser alcohols a year, is to be erected at Billingham.

The I.C.I. range of plasticiser alcohols consists of iso-octanol, isodecanol, *Alphanol 79* and nonanol which, when esterified with phthalic anhydride, are used as plasticisers for p.v.c.

Development work is proceeding to modify the processes used for these alcohols and, furthermore, the capacity of an existing unit producing *n*-butanol and *iso*butyl alcohol by the carbonylation of propylene will be increased. The main use of butanols is as solvents for the paint industry. These projects will raise I.C.I.'s total carbonylation alcohols capacity to over 140,000 ton. p.a.

Sir C. Hinshelwood awarded Royal Society's new gold medal

The Royal Society has accepted an offer by the Trustees of the Leverhulme Trust Fund to mark the occasion of the Royal Society's Tercentenary by the award of a gold medal. It will be awarded by the Society every three years, to the individual who in the opinion of its Council has made the most significant contribution in pure or applied chemistry or engineering including chemical engineering. With the medal will go an award of £500.

The first recipient is Sir Cyril Hinshelwood who has just retired as president of the Royal Society, for his outstanding contributions to physical chemistry.

Insecticide and Fungicide Conference

The British Insecticide and Fungicide Conference will be held at Brighton from November 7 to 10, under the auspices of the Association of British Manufacturers of Agricultural Chemicals. Among the the subjects to be covered in papers to be presented at the Conference will be: systemic insecticides; soil pests and diseases of crops including their control by soil applied chemicals and dressings; potato blight and its control; control of apple mildew; control of botrytis diseases; control of fungi and nematodes by soil sterilisers; new developments including new compounds, novel formulations or new application methods; and the introduction of insecticides and fungicides into agricultural practice at home and abroad.

Scientific workers, in the U.K. or overseas, carrying out research in any of these subjects are invited to make contributions at the conference. They should send short summaries indicating the scope of their papers to Mr. W. A. Williams, Secretary, ABMAC, 86 Strand, London, W.C.2, before March 31.

Pest control course

Brighton Technical College, School of Pharmacy will run a course of six lectures on Disease and Pest Control in Horticulture on Tuesdays from February 21 to March 28.

Lecturers will include Prof. H. W. Miles (Department of Horticulture, Wye College, University of London) and Mr. H. D. H. Womack (Chemist, Shell Chemical Co. Ltd.).

The fee for the course is £1. Applications should be sent to Dr. J. C. Parkinson, School of Pharmacy, Technical College, Brighton 7.

Fumigation company change

Fumigation Services Ltd. of Barking, Essex, have become the fumigation division of the associate company, Disinfestation Ltd. Fumigation Services Ltd. joined the British Ratin Group (now the Rentokil Group) in January 1958.

Rentokil Products Ltd.

Rentokil Ltd., Leatherhead, has been renamed Rentokil Products Ltd. to distinguish it from the various pest control servicing companies which form the Rentokil Group.

Upjohn to enlarge offices and factory

Upjohn of England have outgrown their premises at Crawley, Sussex, and are planning, during the next two years, to extend them by 50,000 sq. ft.

The open interiors which are used in their offices throughout the world will be retained and improved. The new offices will be built upon the existing office block and the fascia of the building will be redesigned to give a horizontal effect keeping the appearance of the building low.

The new factory will be fitted with the latest equipment designed to achieve high efficiency.

Part of the new office will be used to house the expanding European Division under the management of Upjohn of England's chairman, Mr. J. A. Braun; there are now subsidiaries in Belgium, Italy and France besides agents in every other European country.

It is hoped that the new building will be completed by the middle of next year.

Three New Sales Chiefs ▶

Perry
Boots

Broughton
Benger

Lomas
Wellcome

H. B. Lomas has been appointed a director of the Wellcome Foundation Ltd., with special responsibility for sales and distribution.

Mr. Lomas qualified as a pharmacist in 1930 and joined Burroughs Wellcome and Co. as a representative in 1935, being appointed to executive responsibility in the home sales office in 1939. He served also as secretary to the British Insulin Manufacturers. In December 1944 he conducted a market survey of the Middle East and in the following year was appointed to Cairo to establish and manage Buroughs Wellcome and Co. (Middle East). He remained there for more than ten years, and became the first foreign member of the Egyptian Pharmaceutical Society. In 1956 he returned to London. After special assignments in the transport division and in the veterinary division, Mr. Lomas was appointed general sales manager of the veterinary division, and in 1960 became assistant sales manager.

F. C. Perry has been appointed chemist sales manager of Boots, a post in which he will co-ordinate development and marketing of the company's pharmaceutical and medical products throughout the country. He succeeds **C. H. Smith** who has retired. Mr. Perry, who is 44, has been assistant chemist sales manager of Boots since September 1957. A native of Cambridge, he was educated at the County Grammar School there. He joined Boots as an apprentice in 1934, and qualified as a pharmacist in 1939 after attending Nottingham University.

Benger Laboratories Ltd. have appointed **A. L. Broughton** M.P.S. as home sales manager.

During the war years he worked with Martindales in the dispensing and medical department. He joined Genatosan Ltd. in 1946 as a medical representative. He continued in that capacity with Benger Laboratories from 1950 until 1956 when he was promoted to regional controller in the south of England. Last year he took charge of the medical information department.

M. A. L. Banks, A. F. McDonald and **R. B. Southall,** C.B.E., have been appointed to the Board of British Hydrocarbon Chemicals Ltd., and **C. E. Evans** O.B.E., has been appointed managing director. Mr. Banks is a director of BP. Mr. McDonald is a director of Distillers and Mr. Southall is a director and general manager of BP Refinery (Llandarcy) Ltd. Mr. Evans was previously general manager of British Hydrocarbon Chemicals Ltd.

J. A. Reavell chairman of Kestners', has retired. He is succeeded by his son B. N. Reavell. (See page 52.)

C. W. S. Taylor of Ciba Laboratories Ltd. has retired after 37 years with the Ciba group.

Mr. Taylor, a Scot, first joined Ciba in 1924 as a representative in the pharmaceutical department of the Clayton Aniline Co. Since Ciba Laboratories was formed as a separate company in 1934 he has been a pioneer and architect of three important departments. In 1936 he was appointed its first sales manager. In 1949 he was made head of the medical department formed to expand clinical research trials. More recently, he was appointed veterinary products manager when the company entered the veterinary field.

R. H. Mathew, a director of J. F. Macfarlan and Co. Ltd. and of Macfarlan Smith Ltd., has retired. Well known in the pharmaceutical industry, Mr. Mathew started his career with T. and H. Smith Ltd. and was with them 27 years. After a period with William Ransom and Son Ltd. he joined J. F. Macfarlan and was latterly in charge of their Elstree establishment.

Upon the formation of Macfarlan Smith Ltd. in October 1960 he joined the board of that company.

Dr. A. C. Klixbull-Jorgensen of Denmark and **Dr. Emmanuel Mooser** of Switzerland have joined the Cyanamid institute in Geneva as group directors in charge of basic scientific research in theoretical inorganic chemistry and solid state physics respectively.

Dr. Jorgensen has been working for NATO in Paris, and has published more than 50 scientific papers on inorganic chemistry. Dr. Mooser has been serving as a member of the National Research Council of Canada in Ottawa.

A. J. Krajkeman, technical director of Soflor Ltd., has gone to U.S.A. for technical discussions with the associated company in Middletown, New York. He expects to return this month.

J. Ward Vernon, director of research at S. C. Johnson and Son Ltd., has been appointed technical administrator covering Europe, Africa and Near East for Johnson's Wax International. His office is at Thorn House, St. Martin's Lane, London, W.C.2.

Peerage for Sir A. Fleck

Sir Alexander Fleck, K.B.E., F.R.S., was created a baron in the New Year Honours list. He is President of the Society of Chemical Industry and Treasurer of the Royal Society. He retired from the chairmanship of I.C.I. last year.

C. H. Andrewes, deputy director of the National Institute for Medical Research, has been created a Knight, an honour which has also been bestowed on **A. H. Wilson,** a deputy chairman of Courtaulds.

OBITUARY

C. S. Garland, a former vice-president of the Society of Chemical Industry and a president of the National Union of Manufacturers, died recently aged 73. Mr. Garland was a chemist and chemical engineer and was well known for the commercial application of the streamline principle of filtration. He had many interests in education and was a director of several companies in the electrical and chemical engineering industries. He was an M.P. in 1922. Mr. W. Leonard Hill, publisher of MANUFACTURING CHEMIST, says: "I recall with great pleasure Mr. Garland's kindness on several occasions, particularly when, with Prof. J. W. Hinchley, he gave me valuable advice on the establishment of *The Chemical Engineering and Chemical Catalogue*, now the *Chemical Engineering Data Book*."

New directors for Ultrasonics

Ultrasonics Ltd., now 9 years old, is now organised in two divisions: (1) The mechanical division, which is concerned with the manufacture of the patented *Rapisonic* and *Minisonic* homogenisers, and (2) The electronics division, which deals with the construction of the *Rapiclean* ultrasonic cleaning plants.

Mr. John S. Smith joins the board with special responsibilities in the mechanical division. He has taken a prominent part in the application and development of the Rapisonic principle, having joined the company in 1954.

Mr. B. B. Fordham, A.M.I.MECH.E., is the other newcomer to the board. He has been the company's chief engineer since May 1958.

Ultrasonics is a subsidiary of the Croda Organisation Ltd., whose chairman and managing director is Mr. F. A. S. Wood.

Chemical members of exports Council

The Western Hemisphere Export Council is the name of the re-formed Dollar Exports Council. The new body has increased its scope to cover, in addition to its existing markets, the balance of the Caribbean and of South America. Lord Rootes remains as chairman and members representing the chemical industry are Lord Netherthorpe (Director, Fisons), Mr. W. D. Scott (Commercial director, I.C.I.), and Sir Miles Thomas (Chairman, Monsanto Chemicals.)

Laboratory Apparatus and Materials Exhibition

The second Laboratory Apparatus and Materials Exhibition will be held in the Royal Horticultural Society's New Hall, Westminister, from June 19-22, 1961.

Izal-Ronuk export company

A new company has been formed to handle export sales of *Izal* and *Ronuk* products.

It is Izal (Overseas) Ltd. and the chairman is Mr. S. L. Waide, director of the chemicals division of Newton Chambers and Co. Ltd. Managing director is Mr. J. R. Morris, a director of Ronuk Ltd. Ronuk joined the Newton Chambers group in May 1960.

Staff for the new company, which will operate from Portslade, Sussex, has been drawn from the existing export organisations of the two companies. Mr. T. G. E. West continues as export manager, Izal products, based at Thorncliffe, and Mr. J. Radford has been appointed export manager, Ronuk products.

Schenectady-Midland Ltd.

This is the name of a joint company formed between the Midland Tar Distillers Ltd. and the Schenectady Varnish Co. Inc. Erection of the plant is due to commence shortly. It will be situated at Four Ashes near Wolverhampton on the site being developed by Midland Tar Distillers.

Dr. G. A. Collins has been appointed commercial manager of this company.

Briton receives cosmetic award

The American Society of Cosmetic Chemists honoured Dr. Robert H. Marriott at its recent annual dinner. He received the Society's 1960 Medal award for his contribution to chemical research in the cosmetic industry. Dr. Marriott was last year's president of the British Society of Cosmetic Chemists and recently retired as research head of County Laboratories Ltd.

More doctors' hobbies

The Fourth Benger Doctor's Hobbies Exhibition was held in the B.M.A. Great Hall, London. Almost 60% of the exhibitors were doctors who were entering for the first time. There was a welcome reappearance of several old friends who submitted further examples of their ingenious handiwork.

The most ambitious entry was a full-size, two-seater, low-wing monoplane constructed by the doctor himself. It was flown from Scotland to London for the occasion. At the other end of the scale there was a sub-miniature transistor radio set housed in a pocket watch.

THE TECHNICAL PRESS IN FEBRUARY

Modern Heat Exchanger Design

THIS month **Chemical and Process Engineering** contains a special review describing modern trends in heat exchanger design. There are two articles dealing with this subject: Some Design Principles for Heat Exchangers; and Transient Performance of Heat Exchangers. The series on materials of construction for chemical plant continues with a description of the uses of titanium. Also published is the second part of Simultaneous Heat and Mass Transfer by F. Molyneux.

The special feature of **Fibres and Plastics** deals with the applications of glass fibre. This includes articles on glass fibre reinforcements, and woven glass rovings for boat construction. A new series on the structural aspects of bonding commences in this issue and further articles in the series The New Man-Made Fibres, and PVC—Evaluating Its Stability, are also included.

Austria's Schwechat refinery is described in **Petroleum.** Drilling mud problems are reviewed in two special articles from the Fullers Earth Union and Magnet Barium Cove of Dresser Industries.

Another interesting feature is on lighting in the petroleum industry.

Paint Manufacture surveys fluid handling equipment as this month's feature. Other articles include: Flooding and Floating in Paints; Cashew Nutshell Liquid and Cardanol; and another in the series on Advanced Paint Chemistry.

Three important articles in **Corrosion Technology** this month are Developments in Chemical Pretreatments; Corrosion Resistance of Electropolished Metals; and Stainless Steel—Corrosion Resistance in Chemical Plant.

Recent trends in instrumentation are reviewed in **Automation Progress.** With computer applications becoming more widespread the article Computers and New Technology by D. E. Green is of great interest.

This issue of **World Crops** is a special issue dealing with agricultural chemicals and fertilisers. Also of interest is an article on medicinal plants in Hungary.

Advances in filling and capping machines are described in **Dairy Engineering** as well as the manufacture of hydrochloric acid casein in Scotland. There is also a report of the United States dairy show.

Food Manufacture publishes its annual reviews of the baking and brewing industries. There is also a special feature on accelerated freeze drying. This month's factory visit is to Spillers' flour mills at Silvertown.

Chairman of an I.A.T.A. committee which has just produced a new edition of the I.A.T.A. Restricted Articles Code, Mr. J. C. Abbott of B.O.A.C. shows a copy of the code to Sir Miles Thomas, chairman of Monsanto, who transport many chemical products by air. This new edition of the world airline code for the carriage of special cargoes has now become effective on the services of 136 carriers. For the first time it is being issued in book form.

HUNGARY

Another chlorine plant

Hungary's third chlorine plant is to go up at the Balatonfüzió premises of the Nitrokémia Company, near Lake Balaton.

It will cost " several hundred million " forints to build, says the newspaper *Népezabadaág*. (100 forints = £3.)

Larger machines and chemical installations will be delivered by the Soviet Union. The plant will be based on a Soviet design.

NYASALAND

Essential oils

Enquiries are being made by the Division of Natural Resources into the possibility of establishing an essential oils industry, following the claim by a visiting ecologist that Nyasaland has great potential for the cultivation of aromatic plants.

U.S.A.

Cosmetics symposium

" The Scientist's contribution to the safe use of cosmetics " was the theme of a symposium presented by the Committee on Cosmetics of the American Medical Association in co-operation with the American Association for the Advancement of Science. Among the papers read were: The science of safe cosmetic formulation; Radio-isotopes in cosmetic research; and some problems of biological research and their relation to cosmetic development and use.

The first-mentioned paper dealt with the many factors involved in producing a safe cosmetic. The second covered the use of radio-isotopes as tracers in research, and the third discussed the link between the biologist, the dermatologist and the cosmetic chemist, who all share the same problems but who are all motivated for different reasons and who all use their information differently.

Air scrubbing prevents CO_2 poisoning

A method of protecting men against CO_2 poisoning in nuclear submarines—or space craft or other confined quarters—was described at a conference of biologists, physicians, physiologists and other scientists. The conference, on the subject of amine buffers, was sponsored by the New York Academy of Sciences.

The method was described by Dr. K. E. Schaefer, former German naval doctor and Heidelberg professor, now head of the physiology branch of the U.S. Naval Medical Research Laboratory.

Under normal conditions CO_2 makes up 0·03% of the atmosphere; in a nuclear-powered submarine it may rise, safely, to 1·5%—fifty times the normal concentration.

In nuclear-powered submarines CO_2 may rise beyond the safe level, and this makes necessary techniques to " scrub " it from the atmosphere. Dr. Schaefer described the use of amines—chemicals resembling the ammonium molecule—to achieve this end.

One of them, monoethanol amine, he described as a self-regenerating CO_2 scrubbing agent. It absorbs CO_2 when cooled and releases it when heated under pressure. The gas thus removed from the submarine atmosphere can be released overboard into the water.

HOLLAND

Chemical merger planned

A merger is contemplated between the Royal Netherlands Salt Works Ltd., Hengelo, and the Royal Sulphuric Acid Works, late Ketjen Ltd., Amsterdam. The directors are considering the formation of a joint holding company, the shares of which would be exchanged for those issued by the operating companies.

SOUTH AFRICA

Corrosion Council

Mr. F. P. A. Robinson, of the University of the Witwatersrand, who is chairman of the South African Corrosion Council, said that because of relatively low humidity and virtual absence of corrosive contaminants, corrosion hazards in South Africa are insignificant in comparison with other highly industrialised damp regions, such as Sheffield, Pittsburg or Düsseldorf. There is, however, the usual marine corrosion destruction in the coastal regions. As a result of the serious implications of corrosion in industry, a meeting of all those concerned was held under the auspices of the Transvaal Chamber of Industries, and this resulted in the election of a Corrosion Council. It will aim at the prevention of corrosion and help to conserve natural resources.

Tranquillisers controlled

The South African Government have clamped down on the sale of tranquillisers. Popular brands, of which thousands are sold each month, can now be obtained only on a doctor's prescription. Most of the " booster " drugs have been placed in schedule six of the Medical, Dental and Pharmacy Act, which means that they are now classed as potentially dangerous drugs. Others used as sleeping tablets have been declared " part 1 poisons." This means that they can be bought without a prescription but the buyer must sign the Poison Register. The effect of a notice in the *Government Gazette* is to prohibit the free sale of nearly all brands of tranquillisers with the possible exception of one or two. These drugs are milder than the popular brands, but chemists say that two or three could produce the same effect as one of the stronger brands.

A Cape Town pharmacist said that he normally sold more than a gross of each of the more popular brands of tranquillisers every month. Although the " part 1 poisons " tranquillisers could now be obtained by signing the poisons register, he expected these sales to drop by a half. " Before selling them we will have to get the name and address of the buyer, and his reasons for buying them. Most people will not go to this trouble or object to being asked these questions. Our sales of " booster " pills will, of course, drop to almost a trickle."

RHODESIA

Soap perfume

Botanists in Northern Rhodesia have improved their method of extracting oil from the flower of the Nindi shrub, which yields a perfume for toilet soap. It is expected that a marked increase will result in the average quantity of oil extracted from a given quantity of the flowers. The research officer in charge of the work in the Abercorn region of the Northern Province said that his assistants were investigating new strains of the shrub to see if whether it would be profitable to grow it commercially.

AUSTRALIA

Glucose dumping duty

The Tariff Board has found in favour of Australian glucose manufacturers who claimed that United Kingdom competitors were dumping glucose in Australia. This means that a dumping duty is likely to be charged on imports of U.K. glucose which will amount to the difference between the fair market value at time of shipment, and the export price.

Chemical production increases

Latest official statistics show that there are now 512 factories producing chemicals, drugs and medicines. Employees number 22,789, and the annual salaries and wages bill is £23,128,000. Value of land and buildings is £22,949,000, while plant and machinery is worth £38,137,000. Value of raw materials used in the year was £66,179,000; cost of power, fuel, light, etc., was £5,370,000; and total value of output was £137,192,000.

Literature on Sterilisation

Many readers have asked for more information about the sterilisation of medical products following G. R. Wilkinson's articles published in the autumn. Here is a list of the papers consulted by the author. The first article, "Steam Sterilisation," appeared in October, pp. 427-433, and the second, "Gas Sterilisation," in November, pp. 479-483. Most of the references relate to the second article.

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THE CHEMICAL MARKET
This Month's Changes

LONDON.—Prices have remained stable this month. Gums and waxes, which normally fluctuate, have not changed from last month.

Formaldehyde is down 10s. to £39 5s. ton and **hexamine** is down ¼d. lb. on both technical and B.P.C. grades, the new prices being 1s. 7d. and 1s. 10d. lb. respectively.

Silver nitrate is up 3$\frac{15}{16}$d. oz. to 5s. 3$\frac{11}{16}$d. oz. **Zinc oxide** has fallen again and is down £1 to £105 ton.

Caustic soda, solid in drums, dlvd., is down £2 11s. 6d. to £35 5s. 6d. ton., and flake in drums, dlvd., has risen £1 to £36 10s. 6d. ton.

Sodium sulphide has risen £2 in all three grades. Broken is now £39 2s. 6d. ton, flake is £40 12s. 6d. ton, and solid is £38 2s. 6d. ton. All these are in returnable drums, dlvd., 1 ton lots.

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C. W. Walter and R. B. Kundsin, Faulty Function of Table Model Ethylene Oxide Steriliser, *J.A.M.A.*, **170,** (13), 1543.

Royal Institute of Chemistry

February 13. "Reaction mechanisms," by Prof. E. D. Hughes. 7.30 p.m. N.W. Kent College of Technology, Miskin Rd., Dartford.

February 14. "The work of a public analyst," by T. McLachlan. 7 p.m. Norwood Technical College, Knight's Hill, West Norwood, S.E.27.

February 15. "Some recent advances in inorganic chemistry," by Dr. J. S. Anderson. 6.30 p.m. University College, Gower St., W.1.

February 22. "Application of gas chromatography to kinetic studies," by Dr. J. H. Purnell. 7.45 p.m. Technological Research Station, Spillers Ltd., Station Rd., Cambridge.

March 2. "Chemicals from acetylene," by Dr. S. A. Miller. 7 p.m. West Ham College of Technology, Romford Rd., E.15.

March 2. "Some recent developments in gas-liquid chromatography," by Dr. A. T. James. 7.30 p.m. Medway College of Technology, Maidstone Rd., Chatham.

March 7. "Some chemical problems of space flight," by D. Hurden. 7.30 p.m. Hatfield Technical College, Roe Green.

March 8. "Newer chemistry of bile acids and alcohols," by Prof. G. A. D. Haslewood. 7 p.m. Chelsea College of Science and Technology, Manresa Rd., London, S.W.3.

The Chemical Society

February 10. "The mobile stereochemistry of nitrogen," by Dr. K. Schofield. 8.30 p.m. University Chemical Laboratory, Lensfield Rd., Cambridge.

February 13. "Some aspects of atomic reactivity," by Dr. C. Eaborn. 5 p.m. University Chemical Laboratory, Lensfield Rd., Cambridge.

February 16. "Death by poisoning," by Dr. A. Hunt. 5.15 p.m. Chemistry Department, Birmingham University.

February 20. "Some problems in the chemistry of the gallotannins," by R. D. Haworth. 8 p.m. University Chemistry Department. Old Aberdeen.

February 23. Symposium on terpene chemistry, arranged by Prof. A. W. Johnson. All day. Imperial College of Science and Technology, South Kensington, S.W.7.

February 23. "The simplest type of chemical reaction," by Prof. T. L. Cotrell. 6.30 p.m. Chemistry Department, Birmingham University.

February 24. "The structure of bacteria," by Prof. J. Baddiley. 4.30 p.m. Chemistry Department, Birmingham University.

February 24. "Recent advances in the chemistry of D vitamins," by Prof. B. Lythgoe. 8.30 p.m. University Chemical Laboratory, Lensfield Rd., Cambridge.

March 2. "Oxidation in aqueous solution," by Prof. F. S. Dainton. 5.15 p.m. Chemistry Department, Birmingham University.

March 2. "Titrations in non-aqueous solvents," by E. Minshall. 6.30 p.m. Technical College, Brunswick Road, Gloucester.

March 2. "Polymer kinetics," by Dr. T. T. Jones. 5 p.m. Edward Davies Chemical Laboratories, University College, Aberystwyth.

March 9. "Chemical processing of power reactor fuels," by Dr. F. F. Kemp. 5 p.m. University College, Aberystwyth.

Society of Chemical Industry

February 14. "Recent advances in infra-red spectroscopy," by Dr. L. J. Bellamy. 7.45 p.m. Queen's University, Stranmillis Rd., Belfast.

February 15. "Some developments in analytical chemistry," by Prof. R. Belcher. 8 p.m. Stockton and Billingham Technical College. Billingham.

February 15. "An introduction to ion exchange," film. 7 p.m. University College, Cathays Park, Cardiff.

February 16. "Some aspects of the chemistry of iso-quinoline alkaloids," by Dr. K. W. Bentley. 7.30 p.m. North British Hotel, Edinburgh.

February 16. "Oil palm industry," by Dr. W. D. Raymond. 7.30 p.m. Donnan Laboratories, University, Vine St., Liverpool.

February 20. "Some problems in the chemistry of the gallotannins," by Prof. R. D. Haworth. 8 p.m. University Chemistry Department, Old Aberdeen.

February 21. "Polymer science in the University," by Prof. G. Gee. 6.30 p.m. Birmingham and Midland Institute, Birmingham.

February 21. "Some problems in the chemistry of the gallotannins," by Prof. R. D. Haworth. 4.30 p.m. University Chemical Department, West Mains Rd., Edinburgh.

February 21. "Petroleum refining: a chemist's view of today and tomorrow," by E. le Q. Herbert. 7 p.m. Mahratta Restaurant, Grangemouth.

February 23. "The simplest type of chemical reaction," by Prof. T. L. Cotrell. 6.30 p.m. Chemical Department, University, Woodland Rd., Bristol 8.

February 23. "The principles of radiation chemistry and the possibilities of its industrial application," by Prof. F. S. Dainton. 7.45 p.m. Chemistry Lecture Theatre, Queen's University, Belfast.

March 2. "Titrations in non-aqueous solvents," by E. Minshall. 6.30 p.m. College of Science and Technology, Bristol.

March 2. "Some organic compounds of transition metals," by Prof. P. L. Pauson. 5.45 p.m. Chemistry Department, University of North Wales, Bangor.

March 6. "Chemical industry in Sweden," by Dr. A. Dahlen. 6.30 p.m. 14 Belgrave Sq., London, S.W.1.

March 8. Works visit to Cleveland Bridge and Engineering Co., Darlington. Also lecture "Metal spraying for the protection of bridges," by J. D. Thompson. 8 p.m. Darlington Technical College.

March 9. "Water treatment," film. 6.30 p.m. Chemical Department, University, Woodland Rd., Bristol 8.

March 10. "The work of the chemist in bakery," by H. R. Stafford. 7.45 p.m. Agricultural Chemistry Department, Queen's University, Elmwood Ave., Belfast.

Society of Cosmetic Chemists

February 23. Perfumery lecture. 7.30 p.m. Royal Society of Arts, John Adam St., London, W.C.2.

The Royal Society

February 16. "Arrest of mitosis in roots by oxygen-lack or cyanide" and "Dependence of mitosis and respiration in roots upon oxygen tension," by J. E. Amoore. "The induction of sporulation in mould fungi," by A. G. Morton. 4.30 p.m. Burlington House, London, W.1.

February 23. "Some recent developments at the National Physical Laboratory," by Sir Gordon Sutherland. 4.30 p.m. Burlington House, London, W.1.

March 2. "The tropomyosin-paramyosin system in relation to the viscous tone of the lamellibranch 'catch' muscle," by J. C. Ruegg. "Structure of the muscle fibres in the translucent part of the adductor of an oyster," by Jean Hanson and J. Lowy. 4.30 p.m. Burlington House, London, W.1.

March 9. "Analysis of the naphthaleen vapour absorption bands at 3,200A· I. Naphthalene h-8," by D. P. Craig· J. M. Hollas, M. F. Redies and S. C. Wait. "II. Naphthalene d-8," by D. P. Craig and J. M. Hollas. 4.30 p.m. Burlington House, London, W.1.

Institution of Chemical Engineers

February 15. "Science and the developing countries," by P. S. M. Blackett. 5.30 p.m. Geological Society, Burlington House, London, W.1.

February 21. "Floating cap trays for absorption and distillation," by W. S. Norman. 6.30 p.m. Manchester College of Science and Technology, Jackson St., Manchester 1.

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NEW PATENTS

COMPLETE SPECIFICATIONS ACCEPTED

Miscellaneous

Acetylenically unsaturated alcohols and a process for the manufacture thereof and for the conversion thereof into the corresponding ethylenically unsaturated alcohols. *Roche Products Ltd.* 859,898.

Phosphoric and thiophosphoric esters and compositions containing them. *Montecatini Soc. Generale per l'Industria Mineraria Chimica.* 859,737.

Process for the production of polypropylene and catalysts therefor. *Soc. des Usines Chimiques Rhône-Poulenc.* 859,730.

Process for the bleaching of waxes or wax-like materials by oxidation and the new compositions of matter thus obtained. *Farbwerke Hoechst Aktiengesellschaft Vorm Meister, Lucius and Brüning.* 859,433.

Quaternary ammonium compounds. *Glovers (Chemicals) Ltd.* 859,770.

Basically substituted alkyl xanthine derivatives and acid addition salts thereof and a process for their production. *Chemiewerk Homburg A.G.* 859,445.

Dyestuffs

Monoazo-dyestuffs of the oxdiazole series insoluble in water and process for their manufacture. *Farbwerke Hoechst Aktiengesellschaft Vorm Meister, Lucius and Brüning.* 859,444.

Colouring of cellulose acetate or synthetic linear polyamide textile materials. *British Celanese Ltd.* 859,409.

Monoazo dyestuffs derived from benzthiazole. *Imperial Chemical Industries.* 859,899.

Monoazo dyestuffs derived from benzthiazole. *Imperial Chemical Industries Ltd.* 859,900.

Production of phenthazine derivatives. *Egyesült Gyogyszer es Tapszergyar.* 859,379.

Monoazo triazine dyestuffs. *Imperial Chemical Industries Ltd.* 859,990.

Sulphur dyestuffs of the phthalocyanine series. *Cassella Farbwerke Mainkur A.G.* 854,579.

Vat dyestuffs of the anthraquinone series and a process for their manufacture. *Farbwerke Hoechst A.G.* 854,162.

Dyestuffs for dyeing and printing fibre mixtures which cintain fibres containing acrylonitrile. *Badische Anilin- and Soda-Fabrik A.G.* 853,985.

Detergent sulphonic acid and sulphate salts of certain amphoteric detergents. *H. S. Mannheimer and J. J. McCabe.* 853,440

Chromium-containing benzene-monoazonaphthalene dyestuffs and their use. *J. R. Geigy A.G.* 853,998.

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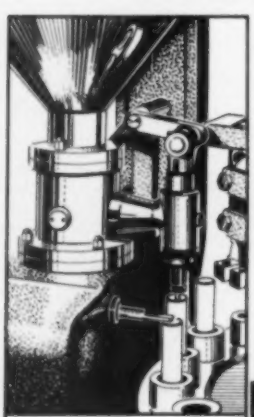

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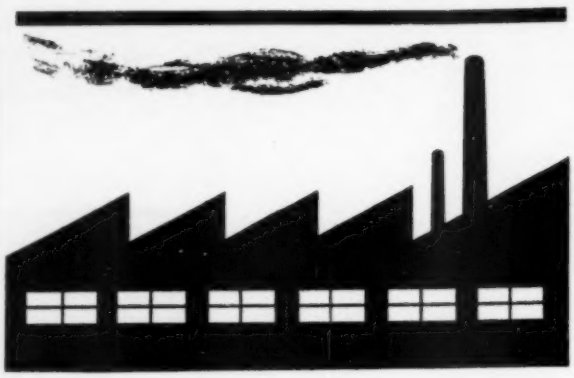

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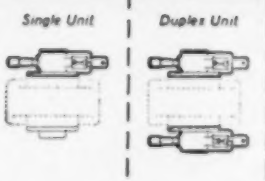

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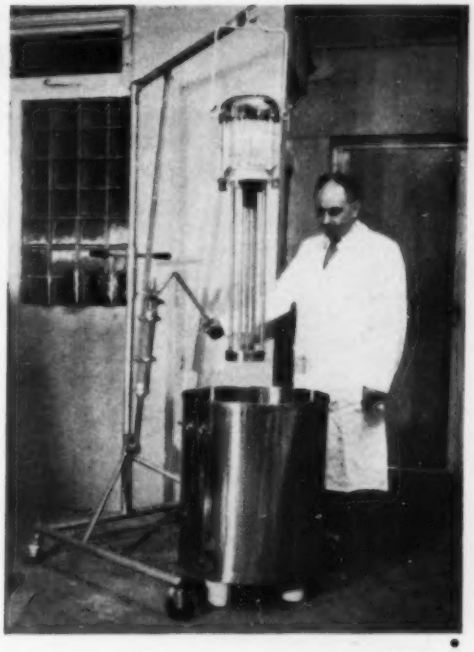

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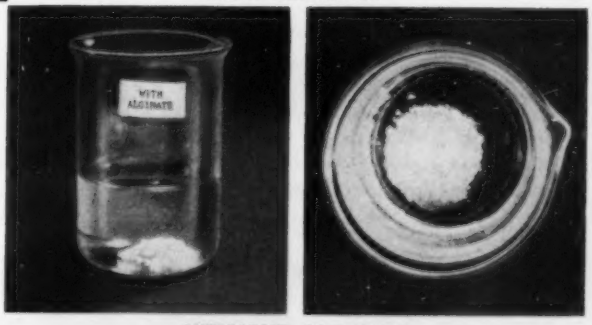

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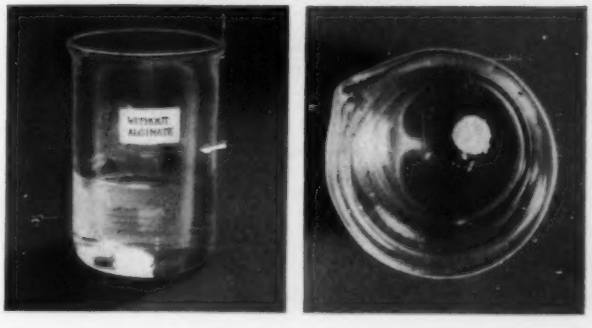

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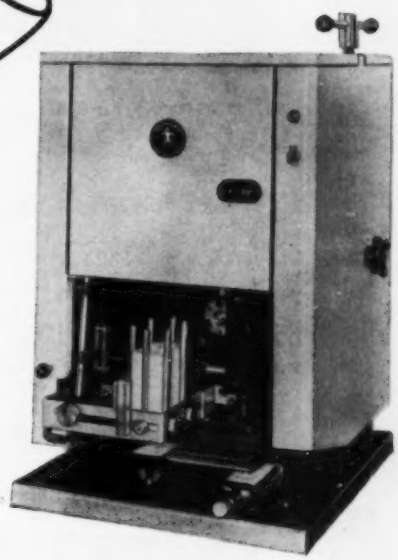

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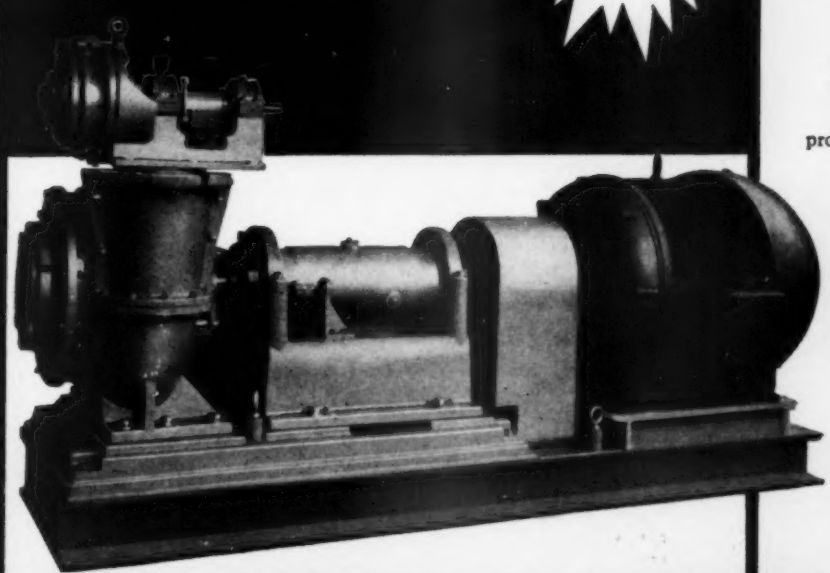

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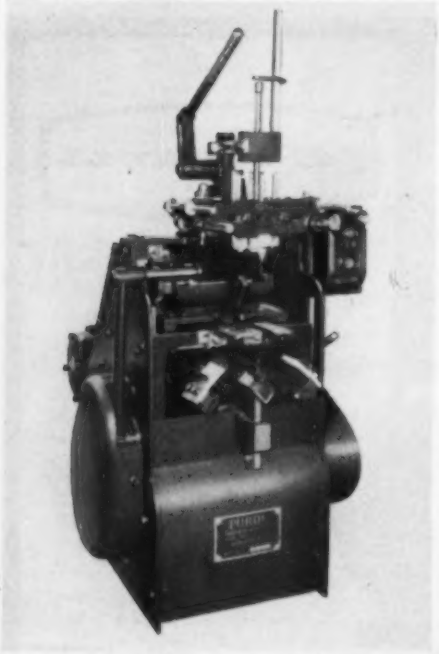

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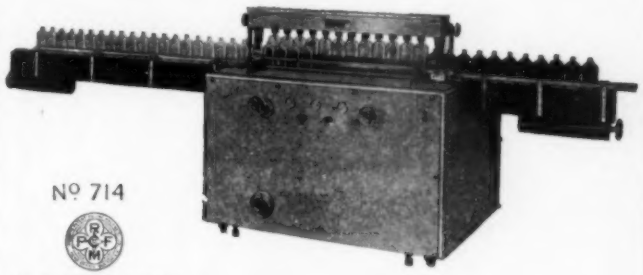

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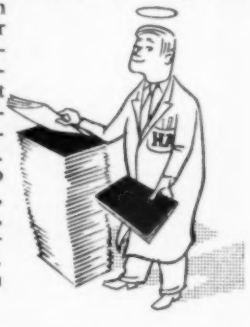

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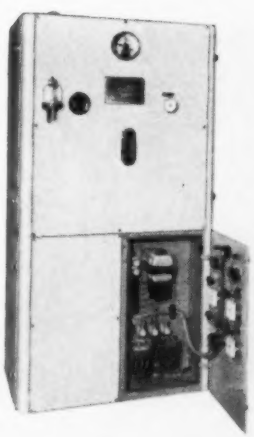

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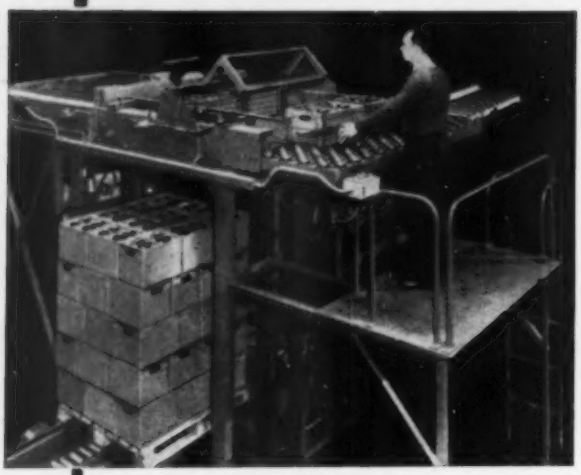

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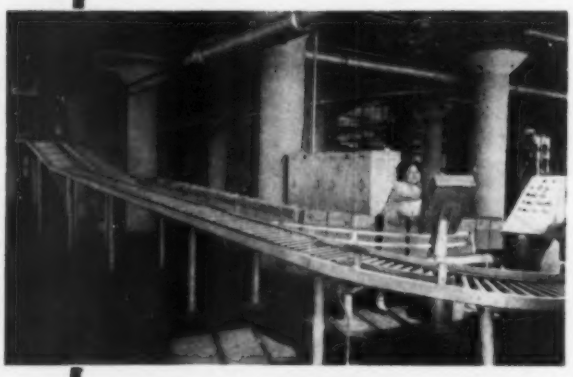

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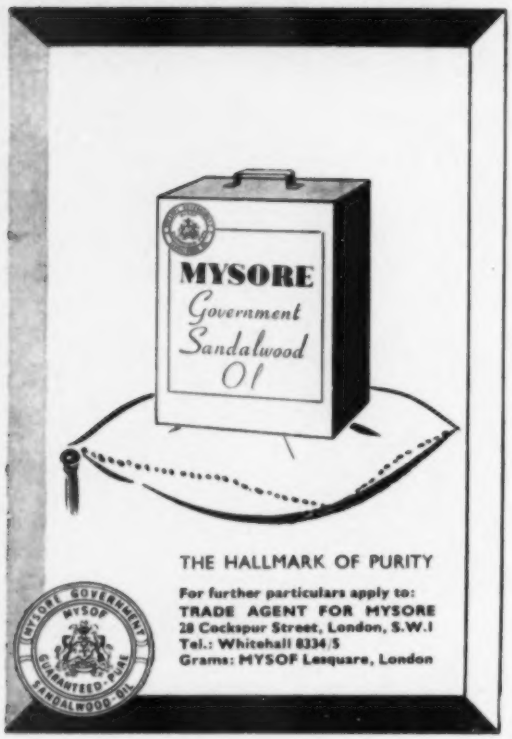

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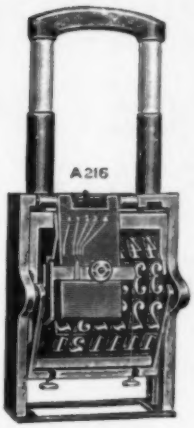

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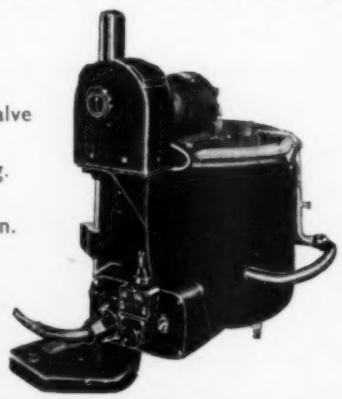

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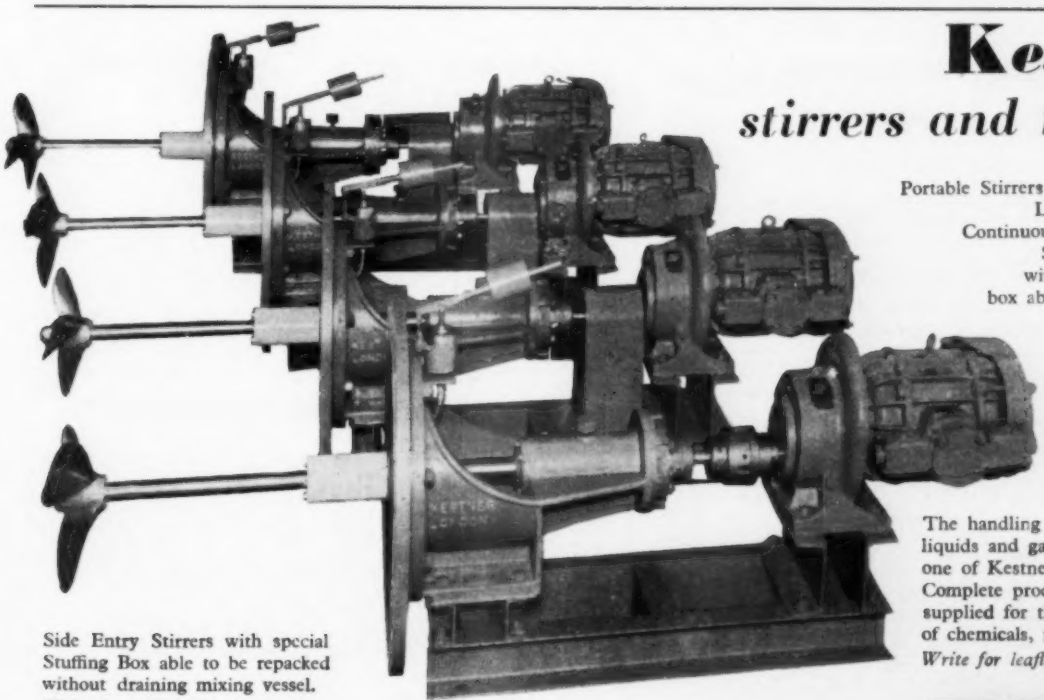

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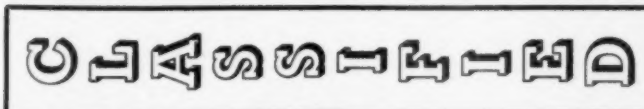

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Ref. A.986. British. Male. Single. Age 57. Inter. B.Sc.Econ., M.I.C.E., M.I.Struct.E., M.I.P.H.E. 2½ years Designer and 2 years Senior Engineer (power station), consultants. 1 year Resident Engineer, Sewage Works, local authority. 1 year Senior Design Engineer (nuclear power factories, steel mills), consultants. 10 months Chief Civil Engineer, (nuclear power station), contractors. 6 months Chief Civil and Structural Engineer—oil refineries, nuclear power, Ministry works—consultants. 2 years Resident Engineer supervising construction and testing of two cement factories abroad, consulting engineers. Seeks post as **CHIEF CONSTRUCTION/CHIEF DESIGN ENGINEER, WORKS MANAGER OR CONTRACTOR'S AGENT**. U.K. or abroad—Iran preferably. U.K. salary £2,250 p.a.

Ref. A.988. British. Male. Married. Age 29. H.N.C. Mech. with endorsements, A.M. Inst. Engg. Designers. Grad.M.I.Mech.E. 3 years Designer Draughtsman, Works Engineers Department, electrical engineers and cable makers. At present Turbine Test Plant Design Engineer, heavy mechanical engineering. Seeks post as **MECHANICAL ENGINEER**. London or N. Kent. £1,500 p.a.

Ref. A.989. Indian. Male. Single. Age 30. **RESIDENT U.K.** B.Sc.Chem. (Indian University) and M.Sc.(Organic Chem.), English University. 2 years Chemist, oils and paints. 3 years Research Chemist, polymers and paints. At present, Senior Chemist (Head of Quality Control), fats and emulsions. Seeks post as **CHEMIST**. U.S.A. or Canada.

Ref. A.990. British. Male. Single. Age 39. 13 years Turret Lathe Operator, brewery machines. 2 years Machine Operator, temperature control instruments. 6 years Improver Machine Shop, telephones, stamp machines. At present Turret Lathe Setter Operator, brewery industry. Has taken 2 years course in General Draughtsmanship. Seeks post as **DETAIL DRAUGHTSMAN (MECHANICAL)**. London. £13 per week.

Ref. A.991. British. Male. Married. Age 37. PI & PII Nat. Cert. Course, A.M. Inst. Plant E. 5 years Apprentice, electrical contractors and electrical equipment manufacturers. 4 years Ordnance Artificer, R.N. 4½ years Refrigeration and Installation Engineer, mechanical and refrigeration engineers. 1½ years Installation Engineer, mechanical and refrigeration engineers. 3½ years Resident Refrigeration Engineer, manufacture ice cream and food products. 4½ years Plant Engineer, manufacture rubber and plastics products (Canada). Seeks post as **PLANT ENGINEER (REFRIGERATION)**. London area. £1,000/1,500 p.a.

Ref. A.992. Hungarian. Male. Married. Age 30. **RESIDENT U.K.** Chem. Eng. Degree. Exemption from Parts I & 2 of Inst. of Chem. Engrs. exams. 2 years Assistant Plant Engineer, petroleum (abroad). 3½ years U.K. experience as Laboratory Technical Assistant, petroleum industry. Seeks post as **DESIGNER OR DESIGN AND DEVELOPMENT ENGINEER (IN CHEMICAL ENGINEERING DESIGN)**. Greater London or Manchester. £900 p.a.

Ref. A.994. Polish. Male. Married. Age 28. **RESIDENT U.K.** H.N. Dip. in Mech. Eng., G.I.Mech.E. 3½ months graduate Apprentice, steam turbine and heavy mining equipment manufacture. 4 years Assistant Development Engineer, fuel injection equipment and electrical accessory manufacture. Seeks post as **DEVELOPMENT/DESIGN OR RESEARCH ENGINEER (MECHANICAL)**. Greater London area—preferably W. London, or would consider Canada. £1,100 p.a. approx.

Ref. A.997. British. Male. Single. Age 29. M.Soc. Instrument Technology. 2½ years Service Engineer, industrial instrument manufacture. 4 years Instrument Engineer, flow metering instrument manufacture. At present Technical Sales Engineer, manufacturers of temperature instruments, indicators, controllers and recorders. Seeks **TECHNICAL SALES POST**. London or Liverpool areas. £1,000 p.a.

Ref. A.995. British. Male. Married. Age 35. H.N.C.Mech., endorsements principles of electricity, industl. admin., Grad. I.Mech.E., applied transfer to A.M.I.Mech.E. 2½ years Apprentice Engineer, rayon yarn manufacture. 4 years Apprentice Engineer and Draughtsman, power plant and refrigeration. 3 years Draughtsman, heavy chemical plant. 9 months Draughtsman on plant development, acetate yarn and fabric manufacturers. 6 years Design and Development Engineer, medium and light machinery. At present Design and Development Engineer, civil construction and mechanical engineers. Experience administration and supervision technical and operative staff on manufacture installation, maintenance and development of machinery, and technical writing and teaching experience. Seeks **SENIOR TECHNICAL ADMINISTRATION AND/OR MANAGEMENT POST—CONSIDER ALL OFFERS INCLUDING TECHNICAL REPRESENTATION** if prospects good. U.K.—not London. £1,500 p.a. min.

Ref. A.996. Irish. Male. Single. Age 30. Qualifications in Agric. and Pharmacy. 1 year Apprentice, pharmacy. 8 months. Warehouseman, rubber company. 6 months Labourer, contracting concern. 9 months Surveyor, and Trainee Seismic Computor, geophysical prospecting. At present Assistant Site Engineer, civil engineering contractors and studying for qualifications in civil engineering. Seeks **CIVIL ENGINEERING POST ANYWHERE**. £700 p.a approx.

Ref. A.998. British. Male. Married. Age 44. Inter. B.Sc., H.N.C., Grad.Inst.P., F.R.M.S. 2 years High Vacuum Technician and 7 years in charge of Laboratory, optical instruments. 5 years Research Assistant, (electron microscope), fundamental research, electrical industry. 6 years Electron Microscopist, fundamental research (paper). 1½ years Metallographer, razor blades. 6 months in charge Production Department, optical instruments. Fluent French. Seeks **POST AS PHYSICIST, INFORMATION OFFICER OR TECHNICAL AUTHOR**. U.K. £1,000 p.a.

Ref. A.999. British. Male. Married. Age 31. Apprentice and 4 years Administration Departments, motor car manufacturers. 3 years Commerical Designer, steel-slotted angle manufacturers. At present Reception Engineer, service station. Experience of layout of service stations and stores layouts and preparation of estimates and brochures and solving of storage problems, designing and estimating of storage equipment. Seeks post as **DESIGNER (STORAGE EQUIPMENT)**. London or N.W. England. £900 p.a.

Ref. B.2. British. Male. Married. Age 37. H.N.C. Mech. C. & G. Final Metal Plate Work. 5 years Apprentice, gas engineers. 2 years Coppersmith, R.N. 7 years Sheet Metal Worker, sheet metal and engineering company. 6 years Draughtsman, chemical and general engineers. At present Draughtsman, engineers and boilermakers. Design experience in sheet metal work, boiler, chemical and general engineering. Seeks post as **ASSISTANT TO WORKS MANAGER OR TECHNICAL DIRECTOR**. London or S. coast England. £950 p.a.

Ref. B.3. British. Male. Single. Age 22. O.N.C. Aeronautical Prod. Eng. H.N.C. Mech. Eng. Engg. Apprenticeship and at present Design Engineer, aeronautical, nuclear and commercial engineering, with experience in Drawing Office and Research Laboratories. Seeks post as **ENGINEER (MECHANICAL) OR TECHNICAL REPRESENTATIVE**. London or Abroad. £800-£1,000 p.a.

Ref. B.4. British. Male. Married. Age 35. O.N.C. (Mech. Engg.). 3½ years Draughtsman, plastics engineering. 1 year Senior Draughtsman, turbines. 5½ years Senior Draughtsman, aircraft. 9 months Assistant Chief Draughtsman, engineering. 2 years in charge Diesel Engine Installation Drawing Office, diesel engines. At present Section Leader, turbines and turbochargers. Seeks post as **SENIOR DRAUGHTSMAN, SECTION LEADER OR CHIEF DRAUGHTSMAN**. S. or W. England (not London), U.S.A. or Europe. £1,000 p.a. min.

Ref. B.5. British. Male. Married. Age 34. O.N.C. (Prod.). 3½ years Jig and Toolmaker, ordnance work. 10 months Chargehand Machine Shop, refrigerator and compressor manufacturers. 3 years Experimental and Design Testing Engineer, regrigeration and electrical engineers. 9 months Light Engineering, Jig and tool Draughtsman. 4 years Assistant Works Manager, precision and general light engineers. At present Senior Production Engineer, Camera and Photographic apparatus manufacture. Seeks post as **ENGINEERING WORKS OR ASSISTANT WORKS MANAGER OR PRODUCTION OR ASSISTANT PRODUCTION MANAGER**. U.K. preferably London or S. Counties. £1,200 p.a. min.

Ref. B.6. British. Male. Married. Age 34. Shotsfiring & Deputies Cert., Mining Proficiency Cert. 8 years Miner and 1 year Official underground including shotsfirer, coal mining. At present Mechanisation Engineer (production Engineering), coal mining. Seeks **PRODUCTION ENGINEERING OR MANAGEMENT POST—MINING PREFERRED**. Abroad. £1,500 p.a. approx.

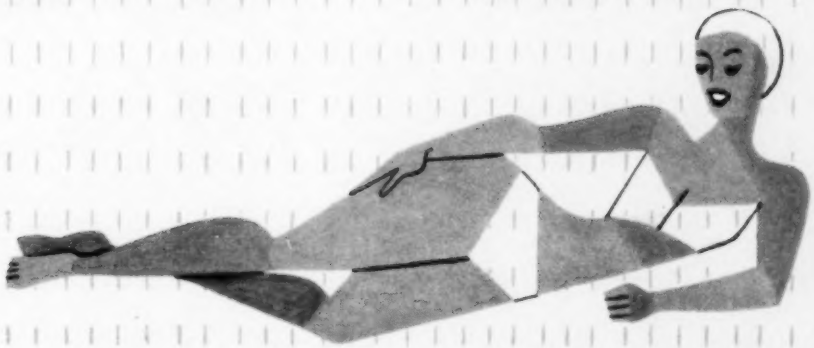
Ref. B.7. British. Male. Married. Age 27. O.N.C. Mech. 5 years Apprentice Draughtsman, 6 months Draughtsman and 1½ years Marine Section Leader—Draughtsman, boiler mountings, high pressure steam and feed valves. At present Senior Estimating Engineer, boiler mountings, high pressure steam and feed valves. Seeks post as **TECHNICAL SALES REPRESENTATIVE—WOULD ALSO CONSIDER PREPARATION OF QUANTITIES FOR BOAT-YARD AND INTERNAL SALES**. U.K.—not London. £1,250/£1,500 p.a.

Ref. B.8. British. Male. Single. Age 27. G.C.E. "A" Level Physics, Chem. & Maths. and studying for H.N.C. Applied Physics. At present Assistant Technical Officer in Research and Development Laboratory, heavy chemicals manufacture. Seeks **TECHNICAL REPRESENTATION OR SERVICE OR LABORATORY POST**, preferably in instruments. In or based upon Liverpool area. £800 p.a. min.

Ref. B.9. British. Male. Single. Age 22. O.N.C. Aero H.N.C.Mech. (Structures). 2 years Junior Design and stress Engineer and at present Design engineer, commercial and aircraft engineers. Apprenticeship in practical aircraft engineering. Seeks **POST AS DESIGN ENGINEERING**. Hampshire (Preferably Southampton area.) £800-£1,000 p.a.

Ref. B.10. British. Male. Married. Age 26. H.N. Dip.(Mech.). 1 year Student Fitter, welding equipment. 6 months Draughtsman gravity die designers. 6 months Draughtsman, contract office. 2½ years Development Engineer, aircraft air conditioning. At present National Service with R.A.F. Seeks post as **DEVELOPMENT ENGINEER**. London or London area. £1,000 p.a.

GIV-TAN® F



GIV-TAN F (Patent Pending) is a new sunscreening agent developed by our research laboratories to increase the efficiency and sales appeal of your suntan product. It enables you to provide maximum sunburn protection—and the deep, lasting, bronze-like tan your customers want—at savings up to 50%!

GIV-TAN F is easy to use. Being a miscible oil, it dissolves and mixes readily in all media normally employed for sunscreen preparations. As an oil it offers special qualities that enhance the cosmetic elegance of your product.

GIV-TAN F is stable in solution and under exposure to sunlight . . . proved in field and laboratory tests . . . harmless to fabrics . . . non-irritating to the skin. It is extremely economical in any type of suntan preparation or sunburn preventive—in hydro-alcoholic solutions, oils, lotions, creams and other products.

GIV-TAN F is not an aminobenzoate nor does it contain other reactive groups and therefore is compatible with dihydroxyacetone.

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WHYTELEAFE, SURREY
Upper Warlingham
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